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Concerning this issue. . .

In honor of the many people, whatever their background, who have given of their time for the sake of the Arboretum, a major portion of this Bulletin is devoted to A Tribute to Amateurs. Professor Herbert Baker writes of the contributions of British amateurs to botany, and Mary Alice Sanguinetti tells the story of the life of Aven Nelson—a professor of English turned botanist—who was firmly committed to the idea of science for the people.

More tribute—to *Cercidiphyllum,* the tree for all seasons. Richard Haag shares his appreciation of the beauties of a favorite tree, and Brian Mulligan describes the Arboretum's collection.

An appreciation of faded plants also is appropriate for this season. Not only can we enjoy the forms and subtle colors of late autumn, but we can learn about the long-dead forests of Washington of 45 million years ago! Robyn Burnham introduces us to paleobotany, the study of fossil plants, with examples from our own area.

And as the weather of our own autumn grows colder, we can more clearly picture the final stage of the Gardiners' adventure in Tibet, with winter approaching the high mountains there, and here.

The staff of the Arboretum and of the Arboretum Foundation join with me in extending greetings for the holidays.

SUSAN LIBONATI-BARNES

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The familiar Simon poplars *(Populus simonii)*, along Lake Washington Boulevard on a misty autumn morning twenty years ago.
Photo: Brian O. Mulligan

The Magnificent Katsura—

Tree of the Future

*RICHARD HAAG**

Editor's Note: This article is based upon a paper presented by Richard Haag at the meeting of the Northwest Chapter of the AABGA, held in Vancouver, British Columbia, in May, 1982.

Taxonomists disagree about the exact relationship of Cercidiphyllum *to other living plants. Depending upon the interpretation of the structure of the female flower, one can argue either that* Cercidiphyllum *is related to the tulip tree (*Liriodendron*), a member of the Magnolia family, or that* Cercidiphyllum *is a relatively primitive plant, unlike any other living seed plant, and that it is the sole remaining member of a once widespread group.*

There can be no doubt however, that the individual leaf of Cercidiphyllum *is a lookalike of that of* Cercis, *the Judas- or redbud tree. The resemblance ends there, since the katsura displays its leaves in a graceful pattern of opposed pairs while the redbud bears alternate leaves. Readers should be aware that the magnificent katsura is not readily available as nursery stock, although public demand might encourage a greater supply of this attractive tree. Anyone interested in* Cercidiphyllum magnificum *should contact the author for further information.*

The Magnificent Katsura

Cercidiphyllum magnificum is a beautiful tree native to the main island of Japan where it occurs in scattered localities in the mountains. As is true of most katsuras, *C. magnificum* is a moderate- to large-sized deciduous tree. The ovate or heart-shaped leaves are opposite on the branch.

Cercidiphyllum magnificum differs from the better-known *C. japonicum* in having leaves rather wider, that are significantly more cordate (heart-shaped) at the base. This shape gives the leaves of *C. magnificum* more of a floating quality, affording greater expression to the wind. The tree is also of smaller size, having a single short trunk that divides into branches above.

Other Katsuras

Other types of katsura include the more common *Cercidiphyllum japonicum*, and a weeping cultivar 'Pendulum', the Shidare katsura, both native to Japan. *Cercidiphyllum japonicum* var. *sinense (C. japonicum* forma *miquelianum),* native to China, was found by E.H. Wilson in 1910. The Japanese and the Chinese katsuras are the largest deciduous timber trees within their forests. The light, soft, fine-grained wood is used for carving, and for making furniture. These trees are found in valley forests on the rather moist concave slopes and on relatively stable colluvial or flooded soils of valley bottoms, indicating broad site adaptability and hence good potential as a street tree.

Katsuras in Cultivation

The Japanese katsura was introduced into cultivation in the United States about 1864, *Cercidiphyllum magnificum* to Europe in 1928. Some of the finest specimens in cultivation in the United States are thriving at the Arnold

*Richard Haag, perhaps best known as designer and landscape architect for the Gas Works Park project, received his Master's Degree from the Harvard Graduate School of Design. He can be contacted at 2923 Fuhrman Avenue, Seattle, WA 98102.

The magnificent katsura, *Cercidiphyllum magnificum,* beside Arboretum Drive in Washington Park Arboretum. This photograph shows the graceful branching pattern and the airy quality of the foliage. **Photo: Richard Haag**

Arboretum near Boston, the Morton Arboretum near Chicago, Dumbarton Oaks near Washington, D.C., and on some of the New England estates. The Washington Park Arboretum has a matching pair of 35-year-old *C. magnificum* 30 to 40 feet high and spreading 25 feet.

Horticultural Attributes

Authorities list the height of katsuras as ranging from 20 to 100 feet, with the consensus of opinion indicating 40 to 60 feet as a reasonable compromise depending upon such factors as location and site characteristics. Marvin Black, Seattle's City Arborist, describes *Cercidiphyllum japonicum* as small and narrow, requiring a 20-foot minimum spacing in planting strips along streets. The spread ranges from a minimum of 15 feet to a maximum of 50.

In my opinion, there is a tendency toward great variability of shape in the katsuras, with the staminate (male) trees tending to be more fastigiate (cone-shaped), sometimes columnar, almost formal, than the pistillate (female) trees which are more broad-spreading, in time, the branches almost pendulous. The form ranges from single-stem pyramidal to multi-trunked broadly ovate, with branches often sweeping the ground in a circle wider than the height of a mature specimen. Even in this graceful form there remains a certain open, airy, light-catching and refracting quality with a finer texture than most deciduous trees. The rate of growth is rapid when young, slowing with maturity; the trees survive to 100 years of age. Stock should be selected carefully to match the space available.

The structure seen in winter is finer-textured than that of most forest trees, with thin, gracefully arching branches. In *Cercidiphyllum magnificum* the young bark is smooth, almost reddish and the older bark is dark brownish, becoming slightly shaggy on mature trees.

The early leaves are burgundy in the bud, breaking into a splendid iridescent claret in early April (sometimes nipped by late frosts), thence evolving through a translucent chartreuse, becoming a transparent green, deepening into a blue-green. They are glabrous on top, glaucous beneath. The foliage is always clean and fresh-looking, and usually features some red tints for accents. I find the sequence of autumn coloration of the katsuras exceeds

all other possibilities in the Pacific Northwest. The fall color is quite variable between and within individual trees. Generally, blue-green pales to green and then to soft yellow, finally to orange, red, scarlet, mauve, pink or purple. This kaleidoscope of colors is matched by another surprise, a definite but difficult to describe sweet, pungent aroma, most unusual. Some have likened it to crushed strawberries, others have said it is similar to burnt sugar. The habit of growth coupled with the pattern and color-phasing of the foliage combine to ensure an outstanding esthetic experience throughout the seasons.

As with most forest trees, the flowers are rather inconspicuous. Borne on separate trees, male and female, they appear before the leaves and are very interesting visually and taxonomically. The flower buds appear in opposing pairs in great profusion over the entire crown of the tree. In addition, numerous flowers emerge directly from the trunk and the main limbs. This example of cauliflory (flowers emerging from the stem) is a botanical oddity in the temperate zone. Although shared with the genus *Cercis*, it is seldom witnessed in temperate zone flora. The small dehiscent bean-like seed pods, clustered at the nodes,

The pistillate (female) flowers and young leaves of *Cercidiphyllum japonicum*. **Photo: D. Normark**

change color from green to yellow to brown, finally splitting to release drifts of tiny samaras. These clusters of capsules resemble diminutive bunches of bananas and are borne in such number as to provide a delightful finale to the autumn coloration of the foliage.

A branch of *Cercidiphyllum* with staminate (male) flowers and young leaves. **Photo: D. Normark**

Although all these offerings are often stunning, I consider the main attraction to be the open pattern of foliage, the leaf to leaf to slender petiole to slender branch stratification, orderly chains catching the sunlight and giving expression to the slightest breeze.

Requirements

The species of *Cercidiphyllum* are hardier than their origin or delicate appearance would suggest, surviving temperatures of -10° to -20° F. Further proof of hardiness is found in the fact that 28 State Arborists list the katsuras on their lists of preferred trees having superior qualities. Included are the states of Colorado, Iowa, Maine, Montana, Nebraska, and Washington, to name but six. The International Shade Tree Conference rates the katsuras in Class No. 1 for the western region, northern section of the United States.

Katsuras thrive in deep, rich moist soil, are adaptable to heavy, wet soils but protest thin and excessively well-drained soils, especially in windy exposures. I find they transplant easily, but may require additional water the first season to gain full vigor. You will be forewarned of drought distress by the wilting of new growth on the topmost branches. Otherwise, this clean, neat tree requires a minimum of care. Utilize pruning to remove any cross-over branches or to maintain a single trunk if desirable. The katsura is remarkably free of pests and pathogens and is pollution-tolerant.

The Tree of the Future

I am puzzled by the fact that *Cercidiphyllum magnificum* remains relatively obscure. It has not been readily available, and perhaps its marvellous variability works against its extensive use. However, I believe the time has come for the rediscovery of the katsuras in general, and in particular of this remarkable tree.

Katsura Trees in the Arboretum

BRIAN O. MULLIGAN

Cercidiphyllum japonicum

The oldest trees of any species of *Cercidiphyllum* in the Arboretum date back to March 1938, when two plants of *C. japonicum* were received from the Drug Plant Garden of the University of Washington's College of Pharmacy. Although there are no definite planting records to substantiate this belief, these are probably the two trees growing on the bank at the east end of Woodland Garden, very visible from Arboretum Drive in their spring or fall foliage coloring. The taller south tree is now about 65 feet in height; the other is three to four feet shorter. No doubt they were planted in 1940 or 1941 and therefore have had 40 years to achieve these dimensions. The bark of both trees is striated and fibrous; the foliage characteristic of the species.

The second introduction of *Cercidiphyllum japonicum* was a single tree given to the Arboretum in February 1939 by Carl S. English, Jr. It is most probable that this is the tree with two trunks that is found on the bank at the head of Rhododendron Glen, on the west side of Arboretum Drive behind the camellias and a large specimen of *Magnolia sargentiana* var. *robusta*. There is a record of two trees being planted here in April 1945, so that evidently the original entry in the acquisition book was

The heart-shaped leaves of *Cercidiphyllum magnificum*.
Photo: B.O. Mulligan

incorrect and Mr. English donated two trees, not one. The sex of these trees has not been observed at flowering time, but since seedlings have been found under or near them it is evident that a tree of each sex exists here. In addition, dissection of the flower buds in August has revealed that the south tree is male, the northern one female. The height is difficult to calculate accurately because of the surrounding native evergreen trees, but the female tree is in the region of 70 feet tall, the other five to six feet shorter. The soil in both these sites is light and sandy, draining rapidly, but the latter area has been watered more regularly in summer because of the camellia plants, which may explain the greater height of these trees.

Cercidiphyllum japonicum is native throughout Japan, from Hokkaido Island in the north to Shikoku and Kyushu in the south. The variety *sinense* (now forma *miquelianum)* is found in several provinces of China, as far west as Yunnan. It has not been grown in the Arboretum here, but does occur at the Morton Arboretum near Chicago.

Cercidiphyllum magnificum

Cercidiphyllum magnificum is found wild only in the mountains of central and northern Honshu, the main island of Japan, and was not separately identified until 1920, by the botanist T. Nakai. This species, the subject of Professor Haag's eulogistic article (this *Bulletin),* reached the Arboretum in the form of seeds from the Botanic Garden at Goteborg, Sweden, in May 1946. As we have recently learned from Mr. Bjorn Alden, the curator of trees and shrubs at Goteborg, *C. magnificum* had been introduced to Sweden from the Botanic Garden at Tokyo in 1928. Since it also went to the Arboretum at Kornik, Poland, in the same year (Browicz and Bugala, 1959), this evidently marks its first entry to cultivation in Europe. The first into this country was through the seeds received here in May 1946.

From the seeds acquired in 1946 eleven plants found their way in due course into the nursery. The first group of four young trees was planted in December 1948 on the west side of Arboretum Drive just south of Woodland Garden; one more tree was added in April 1949, but in December 1957 one was lost from unrecorded causes. Some of the remainder flowered in 1953 and seeds were collected in November of that year; such a period of only seven years from seeds to flowering and seed production is short for any tree. By 1954 the trees were 12 to 15 feet in height, 17 feet in 1955 and up to 22 feet in 1958.

At the present time three of these trees remain with us, two close to Arboretum Drive and one higher up on the bank west of them. Of the two nearest to the road the north one is a male tree now 40 feet in height, with two trunks; the south tree is female, 30 feet in height, with a single trunk. Unfortunately the female tree has been declining for the past two seasons, with reduced size foliage of poor color and now some dead branches in the top; it is unlikely to see this season out, which is particularly regrettable since it is the only source of seeds here of this interesting and rare species. (The cause of this trouble may be the shoestring or honey fungus, *Armillariella mellea*.) The third tree on the upper bank is another male specimen, 36 feet tall. All three have a more bushy habit of growth than *C. japonicum*, with wide spreading branches,

smooth rather than fibrous bark, and short trunks rising about three feet to the first branches. The leaves are generally larger than those of *C. japonicum*, more kidney-shaped than ovate, particularly on the short spur shoots, and having narrow basal sinuses so that the lower lobes may meet or even overlap. The seeds of *C. magnificum* possess a wing at each end instead of only at one, as in *C. japonicum*.

Distribution of Cercidiphyllum magnificum

In 1959 or 1960 sufficient seedlings were raised from seeds of the Arboretum's female tree to offer plants to other arboreta and botanical gardens in the USA. In October 1961, plants were sent to thirteen such institutions, including the National Arboretum at Washington, DC, the Bailey Hortorium at Ithaca, NY, the Morris Arboretum at Philadelphia, and others in Indiana, Tennessee, Alabama and Louisiana. The Master Inventory of the Plant Sciences Data Center, located at Mount Vernon, Virginia, showed in 1979 that plants of *C. magnificum* were then growing at the Holden Arboretum, near Cleveland, Ohio, the Longwood Gardens, Kennett Square, Pennsylvania, and the Saratoga Horticultural Foundation, Saratoga, California. It is of course possible that some of the others may still exist, especially in the southern states, but they have not been recorded by the Data Center. We would certainly like to know of them.

Finally, it may be of interest to quote from the English summary in the article by K. Browicz and W. Bugala (1959):

"*C. magnificum* is very rarely cultivated in Europe. Its seeds were brought to Kornik in 1928 from the Botanic Garden in Tokyo, i.e. hardly eight years after T. Nakai had described this species. In the Arboretum grow eight specimens of *C. magnificum* which have at present a height of up to 10 meters and a trunk diameter of 5-17 centimeters . . . . The trees grow very healthy and even after the most severe winters they were not in the least degree damaged by frost."

Dr. Bertil Lindquist was Director of the Botanic Garden at Goteborg, Sweden, at the time when the seeds of *Cercidiphyllum magnificum* were obtained for this arboretum. He visited Japan in 1952 and saw the tree growing there in the wild state. His account (Lindquist, 1954) contains excellent photographs of the foliage, fruits and seeds of this species, from the plants growing at Goteborg.

Postscript

Since writing the preceding article a comprehensive review of the genus *Cercidiphyllum* by Dr. Stephen Spongberg (1979) has come to my notice. This is entitled *Cercidiphyllaceae Hardy in Temperate North America* and is the sixth in a series of such reviews which Dr. Spongberg is writing on certain genera of woody plants cultivated in the cooler temperate regions of this continent.

In it he provides a key to separate *Cercidiphyllum japonicum* from *C. magnificum*, using the respective lengths of their short shoots, the length and persistence of the stipules, the characters of the fruits (follicles) and the wings on the seeds for this purpose. Other features which also distinguish *C. magnificum* are the larger leaves on the long shoots (up to 8.3 by 5.6 cm as opposed to 4.5 by 3.2 cm in *C.*

The clustered fruits of *Cercidiphyllum japonicum*.
Photo: D. Normark

japonicum), the follicles splitting only in their upper part and the yellowish-white instead of tan-colored seeds. The bark of trees of *C. japonicum* is deeply furrowed, as can be seen in the Arboretum specimens. Furthermore, trees of *C. japonicum* may form several trunks, as has occurred at both the Arnold Arboretum and the Morris Arboretum in Philadelphia. In the case of *C. magnificum* the trees have only single trunks and the bark remains smooth.

Spongberg considers *Cercidiphyllum japonicum* var. *sinense* to be synonymous with forma *miquelianum* of Inokuma, having its short shoot leaves silky-pubescent on the underside along the veins and the follicles also pubescent. Of the four trees of *C. japonicum* in the Arboretum only the south specimen on the ridge east of Loderi Valley shows any trace of such pubescence on the leaves; no fruits have been observed on it. Typical *C. japonicum* is quite glabrous in these areas.

There is a form of this tree sometimes cultivated known as 'Pendulum' which produces only long pendulous branches; it is known to occur also in the wild state in an area in Japan (Iwate Prefecture in northern Honshu) where both *C. japonicum* and *C. magnificum* are found. Based on the morphology of the leaves and stipules Dr. Spongberg considers this to be a form of *C. magnificum* and not of *C. japonicum* as it has been named up to this date. It has never been known to produce flowers.

The extensive Bibliography concluding this review lists 39 references and covers almost two pages. It can be consulted in the Natural Sciences Library at the University of Washington.

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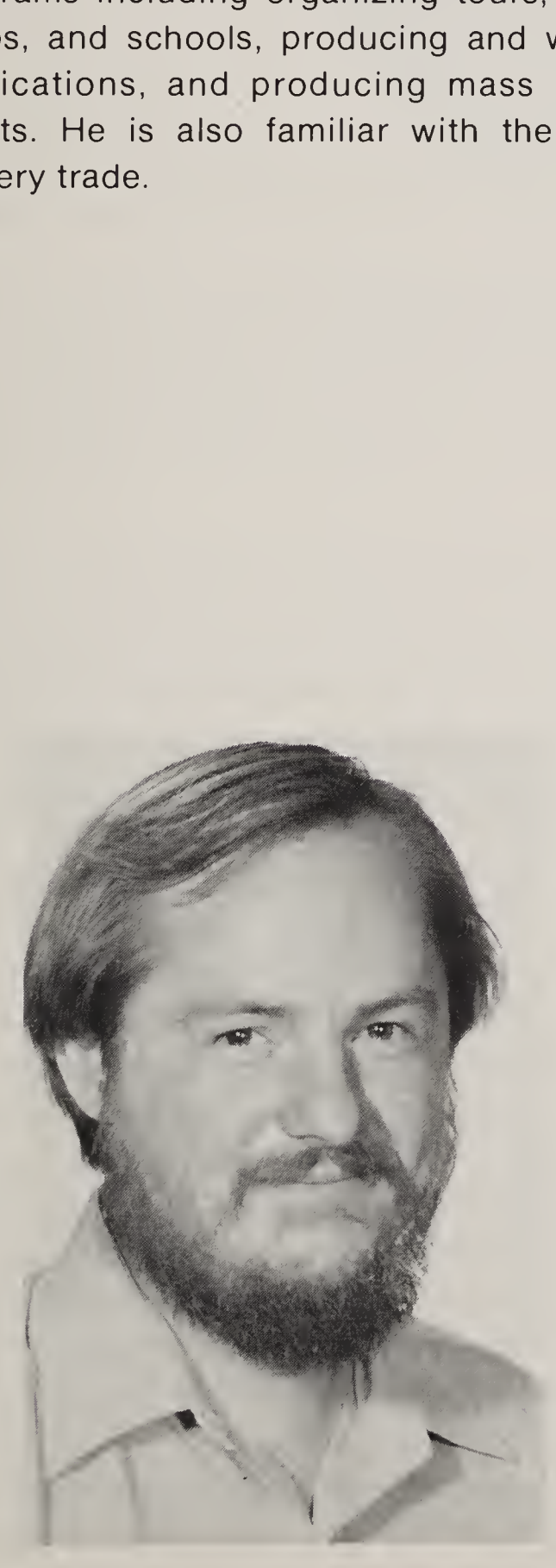
Staff Additions in Urban Horticulture

Diana M. Perl is the new secretary in the Center for Urban Horticulture. She becomes the first full-time secretary for Professors Clark and Wott and her office is located in the Plant Lab Annex Building. Diana is a native of Missouri and has a B.S. in Agriculture (Horticulture) and a Graduate Certificate in Administrative Management, both from the University of Missouri-Columbia. Her specialized background will be invaluable to her work in Urban Horticulture, and makes her a most useful addition to our growing staff.

Mr. Van Michael Bobbitt is the new Coordinator of Continuing Education and Public Service in the Center for Urban Horticulture at the University of Washington. He will be assisting in the development and expansion of programs that seek to appeal primarily to audiences in the public education sector.

Mr. Bobbitt graduated from Central Washington State College, Ellensburg, with a B.A. in Botany, followed by a M.S. in Agriculture (Horticulture) from California Polytechnic State University. While there he worked in the student intern program at Strybing Arboretum in San Francisco.

Mr. Bobbitt was also Education Coordinator and Botanist for the Sherman Library and Gardens in Corona del Mar, California. He has extensive experience in public horticulture programs including organizing tours, workshops, and schools, producing and writing publications, and producing mass media events. He is also familiar with the retail nursery trade.



Mr. William Halstead is the new Greenhouse Supervisor in the Center for Urban Horticulture at the University of Washington. Mr. Halstead's primary responsibility will be supervising and coordinating the activities in the Center for Urban Horticulture greenhouses. He will also be very involved in developing and implementing the nursery and research area at the Center's Union Bay site.

Mr. Halstead is a graduate of the University of Washington with B.S. degrees in both Slavic Languages and Psychology. Currently he is enrolled in the Horticulture Program at Edmonds Community College. Mr. Halstead has extensive experience in both greenhouse and nursery operations, as well as in private gardens.

We wish to welcome Bill Halstead to our center for Urban Horticulture staff. We look forward to having him instruct classes offered by the Center for Urban Horticulture.

A Tribute to the Amateur in Botany

*HERBERT G. BAKER**

Editor's Note: If we define a professional *botanist as a trained person employed in an educational or research institution, then there are several sorts of* amateurs *in botany. There are those whose background consists of formal training in botany but who are working in other fields, and there are those whose botanical knowledge is largely self-gathered. There are those of independent means who expend their energies in botanical research, and others who must work for a living and yet use all of their free time for botany. In both economic groups there are qualified people interested in occasional forays into the realm of botanical investigation.*

All of these types of amateurs have provided significant contributions—contributions that sometimes have been overlooked in our society's orientation toward the value of affiliation with institutions, and the value of work that is compensated by money. We wish to encourage all *amateurs to continue or initiate their work.*

Due to the large number of contributions by amateurs, Dr. Baker has limited his article almost entirely to the amateurs of Great Britain, an area where his breadth of knowledge allows him to choose from a variety of examples and where his familiarity leads to an understanding of events. In other countries, including the United States, the work done by amateurs is very extensive, but this must be the subject of other articles.

Although I have been a professional botanist for forty years, I feel very much more in tune with the amateur botanist than you might expect. I have personal reason to believe that amateurs do good science, because I myself had only two years of formal college education—and did my PhD research without a major professor—in the London University system that allows so-called "External Degrees" to be earned while one is working full-time in unrelated employment. Also, thanks to World War II and the subsequent hard times in Britain, my wife and I grew up as researchers in an environment where expensive equipment was out of the question. Consequently, we have always tried to keep the equipment necessary for our research as simple as possible, and to be as economical as we can be in operating expenses.

On this basis, we believe that amateurs could contribute much more to plant science than they do at present. And we feel that they only need encouragement. In some respects, amateurs are hardly less well-placed to do research than professionals.

In academia, administrative work and innumerable committees take up much of the so-called "research time," and professionals stay productive only to the extent that they work evenings and weekends, and take vacations in botanically-determined places. Thus, in reality, the amateur has almost as much time available for research as the professional.

*Department of Botany, University of California, Berkeley. The substance of this article was presented as the presidential address at Botany '80, the joint meetings of the Canadian Botanical Association and the Botanical Society of America, in Vancouver, British Columbia, July, 1980.

Sir Joseph Banks, botanist himself and patron of others.
Photo: Courtesy of the Hunt Institute, Carnegie-Mellon University, Pittsburgh, Pennsylvania

Here I see a big difference between the Botanical Society of America (to which I have belonged for 23 years) and the Botanical Society of the British Isles (the BSBI, of which I have been a member for 35 years). This is not just a matter of numbers of members. The two societies have about equal numbers of members (between two and three thousand) even though the population of the British Isles is only about a quarter of that of the USA. The difference is that the Botanical Society of America is almost entirely made up of professionals, in institutions, whereas the Botanical Society of the British Isles is an amalgam of professionals and amateurs who are often very competent. I will return to this matter of membership in botanical societies later.

But how did this apparently greater emphasis on amateur botany in the United Kingdom come about? Perhaps we can get some insight by looking at the historical features of British botany.

In Britain, the 18th and 19th centuries were formative times. While botany was becoming established as a science in Europe, there were few professional botanists except for apothecaries, who produced their own supply of properly identified drug plants. Other botanists were amateurs, in the sense that they were not paid for work with plants. Some were independently wealthy, such as Sir Joseph Banks, whose influence was felt widely in the 18th and 19th centuries. His dedication to botany was such that he could never be considered a dilettante. Banks was the self-sponsored leader of a botanical team on Captain James Cook's first voyage to the South Seas, in HMS *Endeavour*. This voyage, from 1768 to 1771, was of enormous scientific and geo-political importance. Sir Joseph Banks was a great figure in British botany for many years afterwards. Since he was the fortunate possessor of great wealth and excellent political contacts, in addition to his own botanizing, he provided

financial and organizational assistance for many other collectors in their overseas activities.

He was President of the Royal Society for many years and his herbarium and library were presented to the British Museum, where they served as part of the foundation of its comprehensive collections. For a while Banks was Honorary Director of the Royal Botanic Gardens at Kew—when they were literally Royal Gardens. The Australian genus *Banksia* is named after him. He also travelled to Iceland and to Newfoundland (but I'm sure the Newfoundland Banks were *not* named after him).

Charles Darwin was a man of independent means—at least *after* the voyage of the *Beagle*, but few other persons have had such an impact on biology—evolution, breeding systems, pollination biology, plant physiology, the study of insectivorous plants and much more. Except for his thinking about the early stages of evolution by natural selection, all his ideas were worked on during the years he spent at home in Down House, in Kent. With his shyness and his illness, he could never have survived the rat-race which we suffer today in the academic world.

Darwin succeeded as a scientist partially because he had money enough to publish. This can prove to be a hurdle not easily overcome by the amateur botanist—particularly in these days of high publishing costs.

Many of the other 18th and 19th century botanists were professionals, although not professionals in botany. For them, botany was, at least at first, a relief from the stresses of daily work. However, in this connection it should be noted that these people were mostly in professions that left ample time for the indulgence of their hobby. Often they were country doctors or members of the clergy who travelled frequently along country roads and paths. They could, and did, appreciate floristics, phenology, and the more obvious aspects of pollination biology.

An outstanding example of the country doctor in Britain is Charles Darwin's grandfather, Erasmus Darwin, who, among other accomplishments, was a very competent doctor, a philosopher, an agriculturalist, a pioneer conservationist, and a political reformer. He is well-remembered for his biologically-inspired poetry, and for his two large books *Phytologia* and *Zoonomia*. Erasmus Darwin had more philosophical influence on his grandson than Charles was originally willing to admit, even though some of his ideas, expressed in *Phytologia*, in which he treats plants as degenerate animals, now seem quaint.

Slightly earlier, in 1776, another country doctor, William Withering, wrote a popular manual called The Botanical Arrangement of the Vegetables in Great Britain. Despite its title, this was the first manual of wildflowers to be written in English. Though we remember Withering particularly as the discoverer of the heart-stimulating power of an extract of foxglove (*Digitalis purpurea*), his now largely-forgotten book ran through many editions and had a strong public influence.

A later variant on the country doctor type

"Sir Joseph Banks' mother, Sarah. . . He described her as being 'void of all imaginary fear', and it was she who encouraged him in pursuing the unusual career of botany rather than the family tradition of politics. The portrait is by John Russell (From the Brabourne Collection, Courtauld Institute of Art)."

Photo: From *Sir Joseph Banks*, by Charles Lyte, courtesy of David and Charles, Inc., North Pomfret,Vermont

was the naval surgeon. Henry B. Guppy was surgeon on HMS *Lark*, when he first made significant observations on the dispersal of plants in the West Indies and in the Pacific Ocean. Naturally, he gave closest attention to dispersal by the sea itself.

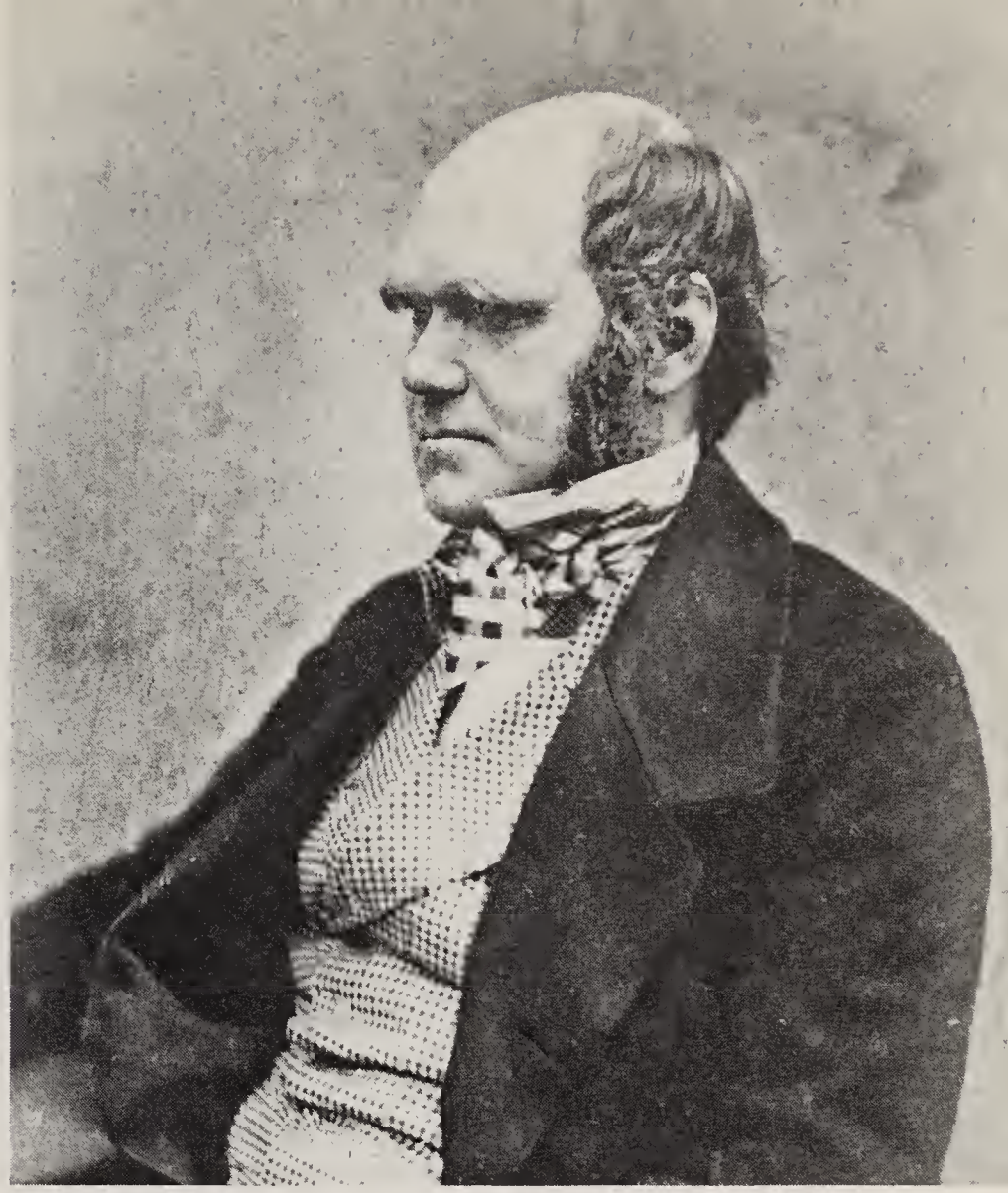
The author and philanthropist Priscilla Bell Wakefield wrote a textbook entitled *Introduction to Botany in a series of Family Letters with Illustrative Engravings*, which was first published in 1796. The letters in the book are between one sister at home in the country, and another away visiting an aunt. Seasonal changes in the flora, plant structure, and the details of the Linnaean classes are discussed. This was a popular book for the education of young ladies, and was printed in eleven editions, the last in 1841. Wakefield felt strongly that botany was a healthy and wholesome activity and hoped that her book would "cultivate a taste in young persons for the study of nature, which is the most familiar means of introducing suitable ideas of the attributes of the Divine Being by exemplifying them in the order and harmony of the visible creation."

Country parsons contributed nobly to British botany. This was to be expected because, in Nature, they could see the handiwork of God. J.C. Loudon, in the early years of the 19th century, wrote in the *Magazine of Natural History* that he published:

> "The naturalist is abroad in the fields, investigating the habits and searching out the habitats of birds, insects or plants, not only invigorating his health but affording him ample opportunity for frequent intercourse with his parishioners. In this way the clergyman at last becomes an advisor and friend, as well as a spiritual teacher."

In Britain, it is notable that the country clergymen included the Reverend Miles J. Berkeley, who is said to have personally named over 6,000 species of fungi, making him Britain's leading 19th century mycologist. However, the contributions of most of the clergymen were to the production of local floras of vascular plants and bryophytes.

Most plant collectors who have been responsible for introducing exotic species to horticulture have been professionals, but there have been some amateurs who were in foreign lands primarily for some other purpose. These



The retiring Charles Darwin.
Photo: Courtesy of the Hunt Institute, Carnegie-Mellon University, Pittsburgh, Pennsylvania

have included religious missionaries, such as the Reverend William Colenso, who in 1834 went out from England to the colony of New Zealand. There he collected and described species of plants for 65 years, giving special attention to those of the mountainous regions. He was elected, presumably *in absentia*, to Fellowship in the Royal Society (of London), and Sir Joseph Hooker dedicated one volume of the *Flora of New Zealand* to him.

Less completely in the country, lawyers have made their contribution. Probably the most famous of these in the 19th century was George Bentham, a taxonomist and flora composer who we most readily think of as part of the team of Bentham and Hooker. This team represents the perfect example of the ability of an amateur and a professional to work together in harmony—which they did at Kew. Bentham was the compiler of the floras of Hong Kong and of Australia, as well as a contributor to many others, and he wrote a *British Flora*, which was subsequently revised by Hooker. The greatest work of this team was the production of *Genera Plantarum*—a conspectus of the world's flora at the generic level, and a new systematic arrangement of the families of plants.

Among the statesmen who were botanists,

one man stands out—Sir John Lubbock, later Lord Avebury. A neighbour of Charles Darwin, he was, among other accomplishments, a banker, a member of Parliament, a Privy Councillor, an essayist, an archaeologist, and an entomologist—as well as a botanist. Between 1870 and 1905 he wrote more on these subjects than anyone, and became renowned as an expositor of biology for the amateur. His rewards were elevation to the peerage, many honorary degrees, and election to scholarly societies.

Anne Pratt wrote several instructional books for younger readers. *The Pictorial Catechism of Botany* was published in London as early as 1842. In it, the structure of the flower is described and the necessity of pollen for seed-setting is stated although the details of pollination and fertilization are omitted.

In the 19th century, among the well-to-do there was a romantic movement in relation to nature. This contrasted sharply with the grim aspects of Victorian life for those without wealth—the very long working hours in the factories of the Industrial Revolution, child labour, strict moralizing and harsh discipline from the family and from society. The surprising thing is that, even in the smoky industrial cities of northern England, some working-class people managed to find the time to join in the appreciation of nature. In the latter part of the 19th century, there were field clubs centered around particular public houses or taverns in the industrial cities.

Some members of the working class made significant botanical contributions to the study of local floras and of plant biology. Outstanding among these was Thomas Belt whose father had run a nursery. He was born in Newcastle-upon-Tyne and he joined the gold rush to Australia in 1851. After that, this largely self-instructed man became a prospector or manager of gold mines successively in Australia, Brazil, Nicaragua, Russia, Canada, and the United States. Belt is most famous for his book *The Naturalist in Nicaragua*, published in 1874—in which he shows that he had read and appreciated Darwinian evolutionary principles and followed them in describing nature. In this book, he described the mutualistic interaction between pugnacious ants and acacias, whereby the acacias reward the ants that protect them from herbivores. The plants provide extra-floral nectar and protein-rich food bodies (Beltian bodies) on the tips of the leaflets. Belt also correctly described the true story of the leaf-cutting ants of the American tropics and their use of the excised bits of leaves as a medium on which to grow a nutritious fungus. He noted that introduced trees such as citrus were more frequently attacked by the leaf-cutting ants than trees native to Nicaragua, and he hypothesized that this was due to the native trees having been naturally selected for chemical protection from the ants.

Not bad for 1874!

Thomas Belt also published a number of papers on the geology of the countries in which he worked. And, to me, it is a sobering thought that when he died, in Denver, in 1878, at the age of 45, he had accomplished more as an amateur with very little time for botanizing than most of us have achieved in much longer professional careers.

I could expand this paper indefinitely by quoting examples from the European mainland of amateurs who have left indelible marks on botany, through dedicated work. No one should forget Gregor Mendel, the geneticist, even though in his time people forgot him.

Gulielma Lister was an amateur in the sense that she was of independent means, but certainly botany was her life work. Daughter of the naturalist Arthur Lister, she edited and revised his monograph *The Mycetozoans* (slime molds) twice during her career. She was sought after as a botanical illustrator and kept extensive field notebooks of drawings and watercolors which are now housed in the British Museum. In 1904, when the Linnaean Society was opened to women, she was elected as a "fellow." She was active in both the British Mycological Society and the Essex Field Club, and served as president in both these organizations.

More recently in Britain, some of the most productive amateurs have also been busy in their non-botanical professions.

George Claridge Druce was a pharmacist who compiled county floras and did pioneering work on topographic botany, greatly enlarging the picture that had begun to be formed in the 19th century. It was Druce who transferred a faltering Botanical Exchange Club into the

Botanical Society and Exchange Club—and helped build up a cadre of topographic botanists who subsequently founded the Botanical Society of the British Isles. Druce was elected Mayor of Oxford, where the University finally gave him an honorary degree. The University now possesses his herbarium as a reward.

The most knowledgeable recent student of the British flora, J.E. Lousley (who was very careful about seeing that his name was spelled correctly) was a bank manager. He was father to many of the current team projects of the Botanical Society of the British Isles.

All of these people contributed to making field botany an activity that could be indulged in by any interested person.

In 20th century Britain, it became common for a middle class household to possess at least a book on flower identification. My parents, who were school teachers, knew the names of all the common wild flowers in our part of Sussex, and this was not considered at all unusual. The great standby at home was *Flowers of the Field*, first published in 1851 by a clergyman school-teacher, the Reverend C.A. Johns. This book ran through at least 29 editions, up until the 20th century!

Incidentally, the system of plant classification used by Johns was Linnaeus' "Sexual System" although Victorian prudery was apparent in his total avoidance of that term for it. He also pandered to the niceties in all editions by referring to the submerged animal traps of bladderwort (*Utricularia*) as air-bladders, ostensibly serving a flotation function for the stem. Butterwort (*Pinguicula*) is similarly excused from being a horrible carnivore, and sundew (*Drosera*) doesn't appear in the book at all.

But I hope I have made it clear that a great deal of solid botany was contributed by these amateur botanists of the centuries gone by.

Much of the development of botany in the domesticated British landscape was of a sort that could be duplicated in the New World, but I suggest that it has not yet developed as fully here because people have been busier combatting and controlling nature, and have not had as much time to study it in a relaxed and abstract way. But anyway, conditions are much more equivalent today. In North America, as in Britain, there is a sizeable segment of the population that wants to get out and observe nature. For them, *The New Naturalist* series of books is published very successfully in Britain (and in the United States). This series was begun during World War II, and it caters at a high standard to the public that is interested in the natural world.

And, in North America, amateurs continue to contribute significant information on pteridology and on the study of other non-flowering plant groups.

But, it has to be admitted that, at the turn of the century, professional botany moved rather quickly away from the taxonomic and floristic emphases that prevailed in Victorian times. Laboratory and experimental work involved plants of which the amateur had never heard. Microscopes, both optical and, more recently, of the electron varieties, have made fashionable the studies of fine structure and molecular biology that are beyond the amateur's easy understanding. Extremely expensive equipment for observation, recording or experimentation, and computer facilities for the processing of accumulated data have become apparent necessities. In the university libraries, to which the public is usually not admitted, there

The talented Gulielma Lister, botanist and artist.

Photo: From "Miss Gullelma Lister," by E.M. Wakefield, Transactions of the British Mycological Society 33:165, 1950, courtesy of Cambridge University Press, New York

has been an accumulation of massive amounts of biological literature written in a jargon that only the initiated can comprehend.

How on earth can the amateur contribute in these circumstances? Well, first of all, I should say that the amateur can still contribute significantly along lines that are traditional but are capable of improvement and expansion. We could do very well with a mapping of the North American flora, at least on a series of local bases. This might be analogous to the production of the *Atlas of the British Flora*, which was compiled by the activity of many amateurs and groups of amateurs each taking responsibility for a square ten kilometers on a side. The information was then brought together by an experienced professional.

Now, under the eyes of professionals, amateur botanists in Britain are making surveys of variation within individual taxa. For example, a survey of the black nightshade (*Solanum nigrum*) complex is being undertaken with supervision from the Cambridge University Botanical Garden. Pollination biology is another area where the amateur can perform valuable research. We are getting away from just the study of individual species and their pollinators, and are realizing the importance of treating the subject in an ecosystem context.

There are also some extra opportunities that were not available previously. For example, the University of California has set up a University Research Expeditions Program and a similar scheme is operated by the Center for Field Research on behalf of the Earth Watch Institute. Members of the public volunteer for expeditions to various parts of the world. These expeditions are designed to provide information for the research program of a particular professional researcher who will lead the expedition. The volunteers thus have an opportunity to satisfy the urge to participate in research and, as part of the preparation for the expedition, they receive some technical training. I think this is an excellent idea, but I would suggest that it would be still more beneficial if the volunteers could put the training they have received to good use in more individual efforts when the expedition is over. It should be more than a memorable experience.

And we have to remember that some of our amateurs of the future will already have received graduate training. Many of these botanists could productively use laboratory and library facilities, if these could be made available. How can their needs be accommodated? One feature of the Botany Department at the University of California at Berkeley has been the appointment of qualified amateurs as unpaid Research Associates. Two of these who have brought their expertise to the department are Marion Cave, expert in cytotaxonomy and embryogeny (particularly of the Liliaceae), and Laura-May Dempster, an authority on *Galium*, bedstraw. Opening up the laboratories, the common rooms and the libraries in this way could be further augmented by letting the empty spaces in classrooms be occupied by qualified auditors.

Botanical garden programs can be, and are being, improved as far as public instruction is concerned. Dr. Robert Ornduff is doing this at Berkeley, and the University of North Carolina at Chapel Hill is providing an example in the excellent programs initiated by Dr. Ritchie Bell.[1]

The equipment problem need not be as serious as it seems to be to some people. Even in a home laboratory there is plenty of good botanical research that can be carried out with simple equipment, aided by what Barry Tomlinson has called "a good eye." And miniaturization and drastic reduction in the prices of computers have put the statistical treatment of data back in the realm of the possible for the amateur.

The chemical botanist R. Darnley Gibbs of McGill University used an admirable series of simple tests for groups of chemicals in plant material—some, for phenols, being as simple as pressing a lighted cigarette on leaves for 3 seconds, or dipping the leaves in hot water and noticing the coloration produced around the damaged area. This simple test for cyanogenesis from glycosides can be very important for those who would study the interactions of plants and herbivores. Irene Baker uses a variety of simple spot tests and chromatographic techniques for sugars, amino acids, lipids,

[1] Bell has been particularly successful in mobilizing amateurs to note cases of native plants being menaced by development, and as a last resort, to transplant them.

phenolics and alkaloids in nectar. In this way, large-scale preliminary surveys can be made, so that other researchers with more sophisticated equipment can follow up on selected taxa.

As to the needs of amateurs for a forum in which to discuss their findings, appropriate societies are necessary. In Britain, the BSBI provides the link between professionals and amateurs, and regional societies in North America such as the Torrey Botanical Club, have long accepted amateurs as members. The California Native Plant Society is primarily devoted to the practical preservation of the native flora of California. These amateur botanists are alert to the danger that weeds may pose to the native flora, and they will form task-forces to go out and root them up. This is understandable because California does seem to attract some of the grossest weeds—like Pampas grass (*Cortaderia jubata*) from South America and several kinds of broom (*Cytisus*) from Europe. Similarly, members of the Washington Native Plant Society have been instrumental in revegetating with native species certain disturbed areas in the national forests. But even with the negative qualities of introduced weeds, the careful study of the success of these plants may be very rewarding scientifically and practically—and I believe it should be encouraged.

So, I appeal to biology departments and botanical societies such as our own to open up their facilities to a greater extent to qualified amateurs, and to sweep away the distinction between amateur and professional.

News from Urban Horticulture

H.B. Tukey, Jr., Director of the Center for Urban Horticulture at the University of Washington, was elected president of the International Society for Horticultural Science at the recent Congress in Hamburg, West Germany. Tukey will serve a four-year term ending in 1986 with the XXII International Horticultural Congress at the University of California at Davis. ISHS has more than 2000 members with representatives from 70 countries on its governing Council. It sponsors numerous symposia in all parts of the world on research problems of production and utilization of horticultural plants. It also sponsors an International Congress every four years.

John Wott was also elected vice-president of the International Plant Propagator's Society, to become president next year.

This is a fine recognition for horticulture in the Pacific Northwest and for the new program in Urban Horticulture.

Events of Interest

Lectures in the Arboretum: WINTER TWIGS, by Jan Pirzio-Biroli, Wednesday January 19, 10 AM to Noon; THE BARK OF TREES AND SHRUBS, by Joseph Witt, Wednesday February 9, 10 AM to Noon.

FOURTH THURSDAY WEEDERS' DAY: January 27, February 24, and March 24. Start the new year with an enjoyable day improving the complexion of your Arboretum.

VOLUNTEERS: interested in special horticultural projects, the herbarium committee, or the seed exchange? Call the Volunteer Coordinator, (206) 543-8800, for more information.

The Arboretum Foundation Unit Council has Arboretum Foundation SWEATSHIRTS AVAILABLE, white lettering and logo on dark green. Please call the Arboretum Foundation office, (206) 325-4510, for further information.

Holly-oak *(Quercus aquifolioides* var. *rufescens*, now *Q. senescens)* on a windswept hillside with the early snow of autumn. This arborescent shrub is used to make charcoal (page 21). Photo: A. Gardiner

The Other Side of the Mountain

A Plant Explorer in Tibet

Part III—The Plants and the Return

JEANNE GARDINER

Editor's Note: This is the third and final article concerning the Gardiners' plant-exploring trek to Tibet. In Parts I and II the journey across China and the approach to the goal of Mount Minya Konka in Tibet are described, and we are given a glimpse of the plants and people of those regions. At the end of Part II, the trekkers had just arrived at the mountain and were settling into camp for their week-long stay. Part III, the present article, elaborates on the high mountain plant life in Tibet, and follows the trekkers back to China and finally home.*

Plant Exploring

On Halloween half the trekkers leave for three days to climb at least as far as Advance Base Camp on Minya Konka, and hopefully to Camp I. Porters carry their food and tents. The route descends to the Butshu, crosses to the left of a huge moraine deposited by the receding glacier, and follows the left fork of the river up and behind the hills which hide the start of the climbing route.

The rest of us enjoy the peace and quiet. Perhaps we can finally go plant exploring. The high hill behind the Gompa (Tibetan monastery) is the goal. Our day packs are filled with seed collecting gear, film and lenses, and extra jackets, though the sun is warm enough

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for short pants! Our lunch has become a daily ritual—a can of Chinese walnuts mixed in a can of pineapple, and pilot crackers on the side.

We climb through brush burn, and wind up a steep and muddy hillside. The snow of two weeks ago has melted from all the exposed spots, including camp, but remains in hollows among the trees. At last we find rhododendrons with seed. We mark them for gathering later because we want to climb higher today, perhaps to the top of the 16,000-foot hill where we may be able to catch a glimpse of the climbers on Minya Konka. Above the treeline the wind blows fresh and clean. Small clouds form as they do every day about noon. When they cover the sun it becomes cold immediately. On the moorlands atop the hill a dead silver forest stretches a mile or more. Cairns of rock and mani piles (prayer stones) march up toward the higher peaks above us.

Kingdon Ward's description of thousands of dwarf rhododendrons fits this location well. He spoke of walking across rhododendrons so thick it is like treading on a carpet—the little plants fill every empty space. Grazing animals have made narrow paths through the mass, but one must often step on the plants to make headway. At this late autumn season we see few other plants, only an occasional gentian. After breathless climbing to about 16,000 feet on the exposed tundra-like hill we head back, only to lose our way through the silver forest. We finally plunge downslope through the dead trees, expecting to cross the original trail. To our dismay we find ourselves in an unfamiliar swale and must follow a strange trail down. It never does cross the first trail. It is not only embarrassing but dangerous to be lost in this country. At last, peering through a clearing, we sight the Gompa far below and to the right. What a relief!

Art has taken many pictures of rhododendrons, with closeups for purposes of identification. One type of rhododendron is of medium size, seven to eight feet tall and as broad. The leaves are oval, four to five inches long, with light tan indumentum. This plant has produced plentiful seed. Another has a fat white bud suggesting good bloom next spring. We press specimens of both and hope someone in the Rhododendron Study Group or at the Rhododendron Species Foundation will be able to recognize to which series they belong. Otherwise we must wait until they bloom.

Camp Life

Yung and friends go hunting with guns and flashlights in the early evening. We hear them returning singing quite late with many pheasants and one rabbit. One night later he shoots a deer which furnishes us with tough meat for a couple of meals.

We learn to fill our water bottles with boiling water at night and push them to the bottom of our sleeping bags, so that we can drift off to sleep more easily with warm feet. The British on treks to Nepal and Sikkim brought old-fashioned rubber hot water bottles with them, kept their feet warm at night, and then used the still-warm water for washing and shaving the next morning. Our plastic bottles furnish us with safe water for drinking and brushing our teeth. Our camp is very cold in the morning

Louise Czerniski (left) and Jeanne Gardiner on a moor at 16,000 feet, gathering seeds of dwarf rhododendrons. Providing a stunning background is Mount Minya Konka.
Photo: A. Gardiner

The 600 year-old Gompa (Tibetan monastery) still houses visiting lamas. **Photo: A. Gardiner**

for we are in shadow till 9:30, when the sun's rays finally hit the prayer flag above the cook tarp. Any spare water bottles left outside the tent are frozen solid.

The porters who returned from Base Camp late last night sit crosslegged in our doorway watching us wash. They bring us plants to identify—today it is a bunch of gentians. Our ticking watches are a source of pleasure to them. They want to trade their possessions for our watches, but each of us places a value on our precious belongings the other cannot understand. One boy covets my Mountain Travel tee shirt and trades his smoking pipe of wood and metal for it. Although the pipe is wrapped tightly in plastic its fumes still penetrate all my gear.

The Gompa

Today we switch-back down to the Butshu River where the climbers started. The river has run various courses over the years and large trees grow in different dry beds. The dry river bed is over 200 feet wide whereas the stream itself is confined within 20-foot banks. The present channel is a torrent of greyish-white snow melt water and is so loud its roar can be heard in camp 2000 feet above.

We scramble over boulders left by the receding glacier or washed down from the sheer cliffs surrounding us. We can hear rock fall from the mountain even here in the clear stillness, and the climbing party said the noise was constant where they camped. The moraine is perhaps 200 to 300 feet high. The trekkers evidently kept to the left all the way, never climbing the mass of rock and boulders, but crossing and recrossing the left fork of the Butshu.

Sea buckthorn (*Hippophae rhamnoides*) is more common here. The yellow berries drip off the spiny branches. It likes the open spaces in the old river beds and grows to 30 feet. It must have been ten or more years since the torrent covered this part of the bed because there are many trees scattered over the dry, rocky ground.

The Gompa stands forlorn in its destruction by the Red Guard. We need a tour and explanation to understand its history. We and Tsen ask one of our porters, Lem, to show us around. He is a tonsured ex-lama himself and nephew of the last head lama who died in 1957, ten years before the monastery was destroyed. At one time it was the home of 115 monks. Lem points out the faint rain-washed paintings on the plastered roofless inner walls exposed to the weather. Buddhas line the broken walls in many positions, one riding a magical horse with cloven hoofs, and another atop an almost indistinguishable elephant. Much of the plaster has fallen but we are told the 70-year-old woman who painted the walls is still alive in Kanding. Outside the Gompa on the hillside in a pile of mani stones is one rock, black with yak butter, outlining the engraved footprint of a young child said to be that of a head lama many years ago. The Gompa may date back 600 years. There have been thirteen living buddhas (head lamas of the Gompa) each of whom became a lama as a child. In the large hall, now destroyed, where the statue of the Golden Buddha was seated, there were 800 gold-covered statues which had been sent to the Gompa from all over the world. (Tibetans have a different expression for "Om mani

padme hum." They pray "Mani dei de homes hei," both translated as "Oh Jewel in the lotus, amen.")

There are several partially destroyed buildings on the site. Each had a different use. The House of the Goddess of Mercy sheltered female buddha sculptures. (We saw many Buddhist nuns in Thailand but we don't know if women lived here as nuns.) The Dung Kor Un was the paper prayer room. One small house was the mani wood house where prayer wheels were turned, and another small cottage is used today as quarters for visiting lamas. A former resident, now very frail, makes an annual pilgrimage to his old home each fall. Our pictures show a gentle old man leaning on a walking stick, assisted by a young girl.

Outside the Gompa the prayer flags are flying once more (such flags were unlawful for 20 years). Local families carve wooden blocks used to print the black or red designs on the white material used for the flags.

The owner of the travel agency who accompanied the climbing expedition to Minya Konka is hopeful of reconstructing the Gompa in the memory of Jonathan Wright, the climber who lost his life in the avalanche. Jonathan, a Buddhist, is buried on the mountain. The Chinese government today is anxious for this symbol to be rebuilt.

Last Days Above the Butshu

Cookie, becoming more confident, offers us exotic dishes. Day lily soup made from blossoms of *Hemerocallis* is delicious. We have pheasant and the one lone bunny in hot sauce. We have tried home-made tofu, and as a special treat black fungus or white mushrooms in a sauce. The first time we try it gingerly, the next we race to get to the bowl first. Once I made blueberry and raspberry cobblers from freeze-dried supplies left from the climbing expedition stores, altogether very satisfactory.

We retrace our steps toward Tsumi on a gentle sun-dappled trail with inviting woods. Our water supply leaps over a little cliff to meet the bamboo pipe. Through openings in the spruce and rhododendron forest there are glimpses of the Butshu far below. We are searching for another trail up to the high hill. There is no path at the first mani pile, but at the second a clear trail through the open forest leads one-half mile to a little cabin, a pony shed, a spring and a small garden space. Thoreau would have been happy here. Now we break our own trail uphill, hot and difficult. We are afraid of getting lost because trees and scrub cover the ground. With frequent glances behind us, we finally emerge far to the left of the other two paths we traveled before on the high hill. We begin to feel at home in this new world.

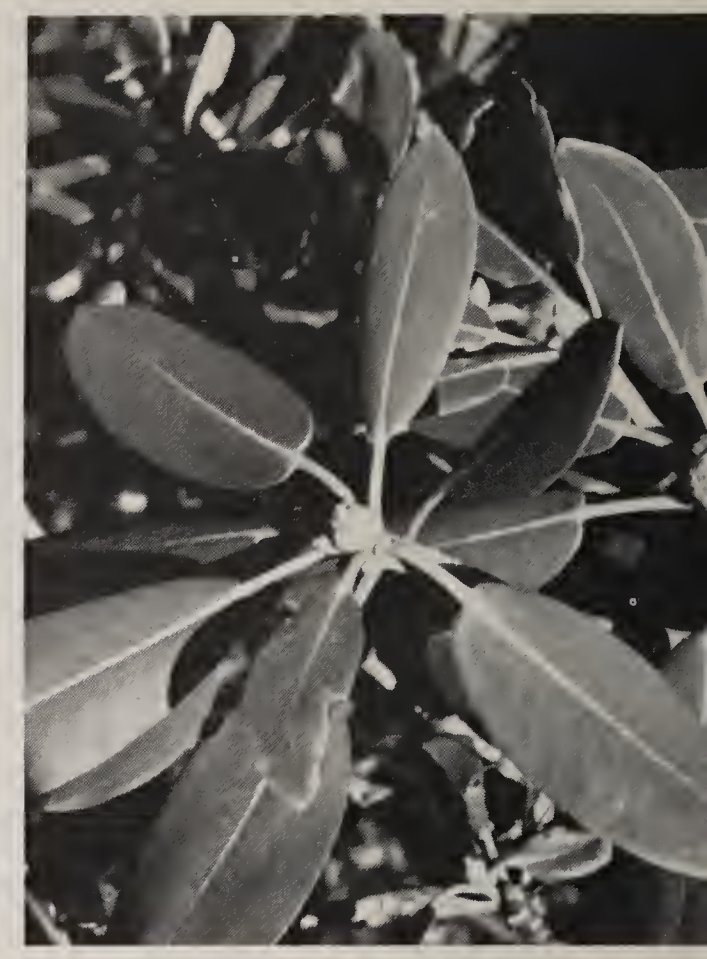
Over the wide open top we stroll, if strolling is the right word for walking a few paces with frequent stops to catch one's breath at 15,000 feet. We find thousands of small round buns of rhododendrons, nine inches to one foot tall, in colorful fall dress of red. We are on the edge of a precipice which will drop us into Tsumi if we aren't careful. After filling envelopes with a good quantity of precious seed, we hunker down into a hollow out of the wind to enjoy our usual lunch. Today is warm with no clouds.

Each night we sleep better. We have the roar of the river far below to lull us to sleep and the twinkle of a million stars overhead. One morning there is a heavy frost and on another a ground fog fills the river valley, leaving us suspended in space until a late morning breeze dissipates it. The weather is telling us our good days are limited and we tell ourselves how lucky we are. The moon is on the wane.

A bouquet of gentians decorates our doorway and we lazily bargain for Lem's carved and silver-embossed knife. He tells me gentians are used in a cough potion and when I ask for the recipe, Tsen laughs, "It is only one of fifteen ingredients!" The holly-oak is useful for something more than fuel. Someone has made me a broom from it to sweep around the tent.

Because so few of us are in camp we become better acquainted with Tsen. We talk about China, its politics and customs. He is the only Communist Party member on the expedition and explains at length the long process of becoming one.

It is our last hike to Rhododendron Hill, our high windswept moor. We have plenty of seed from the small rhododendron which might be *Rhododendron intricatum* (one of the climbers brought me an out-of-season lavender-blue blossom). We descend by our favorite



Clockwise from upper left: Professor Feng W
Iconographia Cormophytorum Sinicorum, Fl
white buds (pages 19, 24). Girl accompanying
old home (page 21). *Daphne retusa* with its sh
River from Liu Baxiang (page 24).

Pei, author of the rhododendron section of
of China (page 26). Rhododendron with fat
rmer resident of the Gompa as he revisits his
eaves (page 24). Trees across the Yulongshi
Photos: A. Gardiner

trail and discover the rhododendron with fat white buds; it is covered with seed pods.

Indian summer continues with fine clear weather. First we walk to the sun-dappled spinney where we found the trail to the cabin. It is sad to realize today we must say goodbye. We again examine a rare plant resembling a rhododendron, *Daphne retusa*. Its shiny leaves with a deep purple underside form a perfect whorl. We crawl over the ground under the plants searching for a chance seedling or old seed capsule. No seed anywhere. The pretty red berries must all have been eaten, or otherwise disappeared. (In England the next spring I examined herbarium specimens sent from a Wilson expedition to Kew and found pressed *Daphne retusa* which had grown within the vicinity we had trekked through.)

The Return Trek

Barberry is turning the most beautiful scarlet and larch is a golden lamp in the deep green forest. Two weeks make a difference as time marches toward winter. In a clearing we take one last look at Gongga Shan beyond our narrow tan shelf where we have camped for a week.

The village of Tsumi appears as peaceful as before, but inside the walled enclosure is hectic activity. The whole courtyard is full of barley which has been cut and is drying. Four young women carry the sheaves of barley into a second compound where a loud belching ten-horsepower motor is chuffing. It ruptures the peace and quiet but it is faster than threshing by hand. The basketfuls of barley are stuffed into the hopper, the chaff is tossed into a pile as it is chopped and the grain drops through slots into a basket beneath. The roast barley grains are ground into flour to make tsampa, a staple food of the Tibetans. We never saw another group-owned motor in all our travels, but then we never had such an opportunity to get so close to an actual working commune that was not just a display for tourists.

Each village is situated near a stream. A small log house sits astride the fast-moving current which turns a large propeller (not a water wheel) beneath. This propeller turns the grinding stones inside the building, producing a fine flour. A sheepskin funnel above the stones drops the barley down the center hole in the top grinding stone. The uncooked flour is mixed into a dough by adding brewed tea and salted yak butter. The dough is molded into a lump and is eaten with the fingers. Each person mixes his or her own in a small wooden, silver-trimmed bowl which is carried in the fold of the garments.

The long day again, heading in the going-home direction. This side of the pass is much steeper. It is so shady here that some of the snow never melts and the rhododendrons on the surrounding hills are in perpetual shadow. This valley must be cut off from the world most of the winter.

Tramping down the Mujo side is easy. Clematis vines, their tousled seed heads white and fluffy, are tangled in all the scrubby undergrowth along the streams. Where villages line the trail, Tibetans stand with their bangles, prayer boxes, knives, powder horns, beads, leggings, and coral and turquoise earrings. At Mujo we make a rule, "No bargaining in the courtyard," or we will be overrun.

Many new characters join us walking along the Yulongshi River toward our destination at Liu Baxiang. A man carrying an umbrella offers me a paper prayer gift which I prize. By means of wood blocks it is imprinted with words from a holy book. The Tibetan paper is crisp and crinkly, different from soft Nepalese paper made from *Daphne bholua*. Though I did not learn which shrub produces the Tibetan paper, the process for making it must be similar. Bark is stripped and boiled. Then the thick, pasty residue is "painted" over screens, dried, and peeled off as thin paper. We saw them making paper for umbrellas in the "umbrella village" in Cheng Mei in Thailand, using this same process.

Back to Chengdu

The next few days driving back to Chengdu slide one into the other. All along the rivers logs cut from forest trees lie on the banks waiting next spring's high water to float as far as the dam at the Chengdu irrigation project. This system of moving logs from forest to mill dates back hundreds of years when rivers were the only roads.

The mountains, cliffs and hanging gardens enclosing Kanding are enchanting. Instead of

Harvest time in the village of Tsumi. The barley is loaded into this motor-driven thresher, then ground to make flour for tsampa. **Photo: A. Gardiner**

bridges, rough stone blocks have been laid in the road, where streams and vehicles share the same bed. It makes for a rough journey as we splash through the flowing water. The entire length of the larger river is white water as it falls rapidly. Vegetation here is not luxuriant but it is still green. Cliffs tower over a thousand feet above us. The region resembles Kingdon Ward's description of an area between the Mekong and Salween divides which was very dry near the rivers. The heights above caught and held most of the moisture. The north-south direction of the mountain masses and the course of the winds help decide the climate. The many-colored cliffs are scarred with seams and crevices; inaccessible plants are tucked into slits in the uptilted rock where moisture collects.

As we quickly drop into the rice lands, the character of the river changes. The valley broadens and flattens, there are no rocks, no rapids. More villages border the road, we begin to see children walking to school, workers with baskets and the ever-present hoe over shoulder. There are nut trees, fruit trees, tile roofs, thatch roofs and hanging corn shucks.

Planted along the road are attractive t'ung trees, *Aleurites fordii*. This tree, which provides an oil similar to linseed oil, grows on rocky hillsides in poor soil, but needs a yearly minimum of 29 inches of rain. The large heart-shaped leaves attract me. The green, apple-like fruit had been harvested in September. The oil is pressed from the seeds, the residue is made into a flat cake and later is dispersed over the fields as fertilizer. Varnish is made by boiling and condensing the oil one hour; boiling the oil for two hours produces a water-proofing for cloth. The beautiful terra cotta floor tiles in the Astor Garden Court at the Metropolitan Museum of Art used a Chinese process of finely ground lime combined with bamboo fiber and t'ung oil, to hold the tiles together.

We pass through Luding quickly and outside of town find ourselves on an unfamiliar road. Er Lung Pass has been closed by massive rock slides. This way will be longer but we will see different scenery. It is mining country. Narrow gauge train rails disappear into a four-foot-high tunnel beside the road. A twelve-inch pipe extends from the tunnel into the air above. Does it emit gas or let fresh air into the mine? Tsen says that this is an asbestos mine.

At 3000 feet the air feels much warmer. We find long-needle pine with eight- to twelve-inch needles. Production teams are making red tile pipe, or red bricks, or white bricks, or are cleaning ditches. We pass into an area where all the trucks are hauling a fine coal like coke. As we round a hill we see many above-ground graves in a large cemetery, the first we have seen. These are called "chair graves," and are common in Hong Kong.

A wide valley is the junction of the Da Du River where it flows into the Min, the large river

involved with the Chengdu irrigation project. This is the general spot where we pass from Tibet back into Sichuan. A section of the river here is called Lui Shan, "Flowing Sand River."

In this more temperate climate are many food products: sweet potatoes, peanuts, rape for seed, with its yellow mustard-like flowers; on roofs grow large squashes. One town is having a Pig Fair—pigs everywhere, carried on bikes, trussed, in carts, butchered, cut up, some herded along the road, all destined for one place—the fair.

Ahead is another pass, Da Sang, narrow and curving, over 8000 feet. As the afternoon lengthens, fog sets in and we crawl at ten miles per hour until long after dark we arrive in Yaan, tired passengers and very weary driver.

* * *

Epilogue

The few days in Chengdu were especially fruitful. When she heard we might be visiting Chengdu, Judy Young, one of the translators from Chinese to English of the new *Rhododendrons of China (Arboretum Bulletin* 44(4):40, Winter, 1981) asked if we would try to find Professor Feng Wen Pei, an authority on rhododendrons and the author of the rhododendron section of the voluminous *Flora of China*. I could not present Professor Feng with a copy of the translation of *Rhododendrons of China* because it was not yet off the press, but we were instructed to introduce ourselves to him at "the University." When we learned that Chengdu has eleven universities it made our task seem almost impossible. (Many universities moved to Chengdu as the winds of war blew around China in the early part of the century.)

One evening a group of us was invited to Chengdu University for an hour's conversation and questions from students and professors who are studying English. Roger Kirkpatrick, an Amherst graduate teaching in the Foreign Language department, routinely buttonholed every visiting American to talk to his students, but this was the first time he had captured a whole group. The students formed circles around us, asking eager questions about our country and some of our puzzling customs. Each of us gave our qualifications, occupation and background, and as I spoke, there was a murmur. Roger explained that most of the Chinese had never heard an occidental woman's voice before. Two of the professors were from the Biology Department and were working with Professor Feng—we made arrangements to visit his office the next morning and our search was ended so easily.

The professors explained that Professor Feng, like many teachers, had had his salary discontinued during the cultural revolution, but "never once did he stop his research."

This revered 80 year-old walks with a cane, is a little deaf, but teaches a full course to about 100 botany students. He studied at Edinburgh Botanical Garden 40 years ago and was at Harvard in 1948-49. I asked if he knew E.H. Wilson and was told, "He was before my time." But he was acquainted with Forrest and Kingdon Ward. He now has *Rhododendrons of China* and his correspondence indicates interest in exchanging herbarium material with the University of Washington.

Speeding through Beijing we enjoyed the usual tourist pursuits—attending an acrobatic show, visiting the Great Wall, devouring lichee-pineapple sundaes in the Peking Hotel, enjoying persimmons while strolling through the Summer Palace.

Seattle

The iris, still in its plastic bag, was passed over to the iris expert, Jean Witt. She has sent bits of it to Australia, and to the University of London to be identified. One plant was left outside in Seattle over winter and proved to be hardy. We eagerly await its first bloom because it may be new to cultivation. There was little seed from this expedition, but five kinds of rhododendron seed have germinated and the small plants are thriving.

I can hardly wait for the next notice in a travel brochure: anyone for Timbuktu?

Aven Nelson and the Rocky Mountain Herbarium

MARY ALICE SANGUINETTI

In 1887, Aven Nelson joined the faculty of the University of Wyoming as an English professor with an interest in natural history, and went on to found the Rocky Mountain Herbarium, now the world's largest collection of Rocky Mountain plants. For more than forty years he taught botany and collected plants throughout Wyoming and the Rocky Mountains, discovering, collecting and naming a multitude of western species formerly unknown to botanists. It is in tribute to the work of a dedicated botanist who was not originally trained as such, and of a person who believed in carrying botany to all people, that we include his story here.

Early Years

Around the year 1848 a group of Norwegian pioneers settled in the hilly, wooded region between the Des Moines and Mississippi rivers, near Keokuk, Iowa. Among them were Christen and Anne Nelson, the Quaker parents of Aven Nelson. Aven, the youngest of four children, was born on March 24, 1859 and grew up on the nearly self-sufficient farm where his parents had settled. Of his growing up in Iowa, Aven Nelson wrote in 1943:

> "From childhood up I may classify myself as a 'nature lover'. My father's little hilly wooded farm was to us children a botanic garden. There was real competition in the finding of the first wind-flower and spring beauty. We had folklore names for many others. By the time I was a full farm hand my curiosity extended to the gorgeous flowers that thrived in protected corners of the zig-zag rail fences. At 17 I was a full-fledged country school teacher. Friday afternoons we took time off for 'nature work', and I raced up and down the hills and ravines with my whole flock in hot pursuit of the birds and the flowers. By that time, I had armed myself with a copy of Gray's Manual (6th edition). This, however, was a disappointment, for it was the first and only book on systematic botany I had ever seen. Nothing had led up to the vocabulary that I encountered."

Aven Nelson taught for three years, saving enough of his salary to attend the Normal School at Kirksville, Missouri. Before leaving Kirksville he had obtained a position at Drury College where he was an instructor in English and professor of natural sciences. Later he taught elementary botany and in 1944 said of this experience, "I assure you it was elemen-

The young Aven Nelson, scholar and eventually president of the University of Wyoming.
Photo: Courtesy of the American Heritage Center, U. of Wyoming, Laramie

tary indeed. The course drifted into a sort of a glorified course in nature study. I discovered . . . that in the absence of knowledge, enthusiasm will do much to cover up the deficiency."

In 1885 he accepted a position as superintendent of schools in Ferguson, a suburb of St. Louis, Missouri. Before going to Ferguson he married Celia Alice Calhoun. The Ferguson school board did not approve of some of Aven Nelson's activities. He built a home and dug the cellar himself. He also let school children do some planting with their own hands on the school grounds as part of an Arbor Day program. When he heard of a proposed state university at Laramie in Wyoming, Aven Nelson decided to go to Laramie and grow up with the institution.

Laramie and the World's Fair

On July 25, 1887, at the age of 28, when the first University building, Old Main, was two-thirds completed, Aven Nelson arrived in Laramie. Nelson had been elected to "the chair of English" but since there were two English professors among six faculty members, and because of his interest in plants, he became Professor of Biology.

In 1891, the Experiment Station was established at the University and Aven Nelson became Botanist for the station, a position which he held until 1941. During this year he collaborated with B.C. Buffum in publication of the first bulletin of the Wyoming Agricultural Experiment Station. He later wrote or contributed to seventeen bulletins of the Experiment Station.

In the fall of 1892, with his wife and daughter, Nelson went to Harvard for a year's leave of absence. During this year he studied physiology and morphology of plants and animals. At the end of the year President Eliot presented him with his Master's Degree in Science.

When he returned to Laramie Nelson found that B. C. Buffum, who had substituted for him during his leave, had collected extensively and had made hundreds of herbarium specimens. President Johnston expected Nelson to identify them and establish an herbarium. Buffum had collected samples of Wyoming forage plants to be exhibited at the 1893 Chicago World's Fair. He also had prepared herbarium specimens of the general flora in sufficient quantity that duplicate sets could be prepared. Equipment for working with the herbarium was meagre and included two inadequate books, *Gray's Manual of Botany,* which covered the central and northeastern United States and adjacent Canada, and Coulter's *Manual of the Botany of the Rocky Mountain Region* which was little more than a compilation from the collections made by early explorers. Many plants did not fit any of the species described in these books. Consultants at the Gray Herbarium often returned puzzling specimens with the names of eastern species. Nelson was not satisfied with this; he was convinced that they were new species.

In any event, Aven Nelson and Professor E. E. Slosson demonstrated Buffum's collection of forage plants in Chicago and received a medal for the grass collection and more than twenty awards for the grain display!

In 1937, Nelson looked back on his early herbarium work and wrote:

> "I had to begin at the bottom. I had no conception of families, to say nothing of genera and species. Provided with a dissecting microscope, forceps and needles, a bottle of water, an alcohol lamp, some watch glasses and a test tube in which to boil up the dried blossoms, the work was on . . . The whole setup also got me into trouble with the family—I'd often forget to go home to my meals . . . . Each summer, with members of my family in a big camp wagon, we scoured the plains for more treasures. In no sense, however were these field trips primarily pleasure trips—we labored like harvest hands, for all expenses had to be met from the sale of duplicate sets. Fifteen to twenty specimens of each number was our objective. Thus the work went on for many years . . . . The job then and always that kept bread and butter on the table was teaching; the things I did when I could do as I pleased were field and herbarium work."

Summer Field Expeditions

In 1894, the Board of Trustees made provision for a summer field expedition by the departments of geology and botany. On July 7, 1894, Aven Nelson, W.C. Knight, Professor of Geology, George M. Gardiner, a student and

W.H. Reed, the owner of the horses and wagons, departed from Laramie. The botanists's outfit included two tin collecting cans, one with small compartments, one large tin vasculum (a metal box used for collecting plants), a carpenter's chisel for uprooting plants, a stout knife, and five plant presses of which four were slat presses with straps and one was a screw press. This screw press was homemade and had the advantage that "coarse harsh plants can be forced into shape and held there" (Nelson, 1896). The party crossed the state diagonally, camping near good collecting grounds and partly living off the land. Traveling about 1000 miles to the Jackson Hole country and back they collected many new species of living plants and visited oil seepages where they found valuable vertebrate fossils. At noon each day plants collected in the morning were pressed and in the evening they prepared the afternoon collections—sometimes by campfire.

"First Report on the Flora of Wyoming" by Aven Nelson (1896), traces the route from Laramie northeast over the Laramie Hills. They camped at Alkali Springs where there was no drinking water and they forded the Big Wind River 13 times. On August 11, they reached the 9500-foot summit of the Wind River Mountains where "the open parks among the Spruce groves were covered with the wildest profusion of flowers—a veritable botanist's paradise." The party reached the Snake River in Jackson Hole and began the ascent of the Grand Tetons but were stopped by a chasm, and were forced to return.

During 1895 four more expeditions were made, concentrating on those species not collected in 1894. Nelson (1896) noted that one must consider soil, moisture, and exposure as well as altitude when discussing plant zones. At best, altitudinal plant zones could only be established for a given region, and some plants occurred at all altitudes, regardless of zone. The plains flora of Wyoming showed much variation in soil, rainfall, and altitude although all of the plains were relatively level and treeless except for cottonwoods along streams. Two types of vegetation were observed in the foothills: wooded and denuded; the mountain flora included some heavily wooded areas. The "First Report" includes a list of 28 tree species found in the state of Wyoming, and the comment that "In a few localities of the state occasional specimens of Sage Brush attain a remarkable size—small trees in fact—so that a man on horseback may ride erect underneath the branches." It was also observed that the continental divide did not separate floras and the regions close by on either side had more common characters than differences. Nelson's field trips continued every summer until he was required to teach during the summer session.

The Rocky Mountain Herbarium

The Rocky Mountain Herbarium was established in 1899 when the Trustees of the University so designated the plant collection which Buffum and Nelson had begun. This herbarium was to become first in size and facilities in the Rocky Mountain region; each year it has received hundreds of specimens from Colorado, New Mexico, Utah, Idaho, Montana and the Dakotas.

The first real botanical exploration of Yellowstone took place at this time also. At the time of this expedition to Yellowstone Park the University had 142 students and 15 faculty members. One of the students, Leslie Goodding, was selected as helper for a salary of $10 and expenses. The party consisted of Aven and Alice Nelson and their two daughters, Elias Nelson (an unrelated assistant) and Leslie Goodding. They first took the Union Pacific and Oregon Short Line to Monida, Montana, about 75 miles from the park. The equipment with which they left Monida included a light covered wagon with two spring seats, a mess box which formed a table, a new 12x14 foot tent with stout ridge poles, a sheet iron stove with three joints of pipe, a table with four detachable legs, and bedding. They also took six plant presses, two good draft horses and a small saddle horse. The trip took fourteen weeks. They went through Yellowstone Park and Jackson Hole collecting plants. The party followed the Madison River and then the Gibbon River. The collection made during this trip was a nucleus for the *New Manual of Rocky Mountain Botany* by Coulter and Nelson.

The first set of plants from this expedition is deposited in the Rocky Mountain Herbarium. Aven Nelson noted that Yellowstone Park had

many species which were far from their supposed range. He observed (1900) that "Delicate-appearing plants, each morning procumbent under a heavy load of frost, are after a few moments of sunshine, as jauntily erect, in all but their brilliancy of color, as if they had never felt any but the balmiest breezes."

Human Encounters While Collecting

Nelson reported (1900) that on various collecting trips in Wyoming his collecting case had been mistaken for a water-tank, an oilcan (for collecting samples), a mail-bag and a gas-tank for supplying soda fountains with CO_2. While collecting in Yellowstone, "One intelligent tourist watched for some time, my assistant collecting a small, bright-colored flower (*Mimulus nanus*) and then astonished him with, 'Do you use those for fish-bait?'." On another occasion Nelson was mistaken for a peddler, stopped and told that "Peddling without a license was not allowed."

Philosophy of Botany and Education

Aven Nelson's thoughts on education are as relevant and valuable today as they were eighty years ago. He believed that nature courses, including botany, should be offered to students of all ages and that the courses should be challenging and interesting. Students should work first with the plants and only later use books, after they had developed an interest in botany.

In 1905, as secretary of the newly created State Board of Horticulture, Aven Nelson traveled through Wyoming telling ranchers to plant orchards and gardens, and advising them about which fruits and shrubs would grow there.

About this time he also began revising Coulter's *Manual*. Due to the wealth of new information this was published in 1909 as the *New Manual of Rocky Mountain Botany*.

Aven Nelson had definite ideas about the place of botany in everyone's life, not just in that of trained scientists. At the International Congress of Plant Sciences in 1929 he criticized the complexity of classification, stating that:

> "Our system of classifications and our nomenclature have become so complicated that even an educated laity has been unable to follow. Other interests and pastimes—notably athletics, motoring and the movie—have bidden with the insistent publicity for recognition. The results have been a deadening indifference to the charms of the living world and we as a people have lost the cultural value of a science that can do so much to promote that type of happiness that comes from a sympathetic contact with and an adequate understanding of that part of our environment that brings re-creation to our bodies, joy to our minds and peace to our souls—the world of life about us."

He partly blamed taxonomists for this indifference of the public. He felt that many professionals were unwilling to talk to the public. He pointed out that public ignorance could result in bad legislation, so that it was the responsibility of scientists to share their knowledge. Consequently, botanical manuals should be simple and understandable. He argued that if plant taxonomy were included in high school and college curricula, there would be trained and sympathetic teachers for nature study classes. Such courses would also engender respect for the science of botany among patrons of the schools as well as cooperation from other botanists and biologists. Through the study of taxonomy, interest, initiative, judgment and common sense would be developed among youth and thousands of amateurs would find their pleasures in the out-of-doors immeasurably enhanced. Another result would be the enrichment of life and letters through a finer understanding and keener appreciation of the environment.

Later Years

In 1929 Alice Nelson died and Aven Nelson, now seventy years old, began to spend less time teaching and to devote more time to his beloved collecting and research. However he continued to teach at the summer science camp and acted as Curator of the Herbarium for ten more years.

Ruth Ashton came to Wyoming as a graduate assistant in the Rocky Mountain Herbarium in 1930; she and Nelson were married in New Mexico in 1931. In the following years they extended their plant-hunting to British Columbia, Montreal, Alaska, Florida, Mexico and

even Europe.

On March 31, 1952, at the age of 93, Aven Nelson died in Colorado Springs, Colorado. He is remembered today as one of the pioneer botanists of the West. Throughout his lifetime Nelson contributed to science, to the University of Wyoming and to education. As well as founding the Rocky Mountain Herbarium at the University of Wyoming and teaching the first botany classes, he planned and supervised planting of trees on the University campus and did much of the planting himself. His work is commemorated by the Aven Nelson Memorial Building at the University of Wyoming where the Rocky Mountain Herbarium and Department of Botany are located. The herbarium is now comprised of over 300,000 plant specimens and is one of the best known herbaria in the United States. In his life Aven Nelson grew from a one-room school teacher leading his students out into the fields on Friday afternoons to one of the West's leading plant explorers.

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Errata

Volume 43, No. 4, page 24, Winter 1980

According to the latest nomenclature, *Toona* is the correct generic name for the Chinese toon plant, and *Cedrela* is the synonym.

Volume 43, No. 4, page 30, Winter 1980

A note from one of our authors reads: "I regret an error in the paper "Discoveries and Introductions". . . where I. . . misidentified the commonest of the Bergenias as *B. smithii*. Had I checked my facts as scrupulously as I should have, I'd have noted the slight slip of memory, for it is the old German hybrid X *schmidtii,* introduced by Hage and Schmidt at an unrecorded date over a century past, and now by the rules dictating horticultural nomenclature it is to be called 'Ernst Schmidt'." B. LeRoy Davidson

Volume 44, No. 3, pages 21 and 24, Autumn 1981

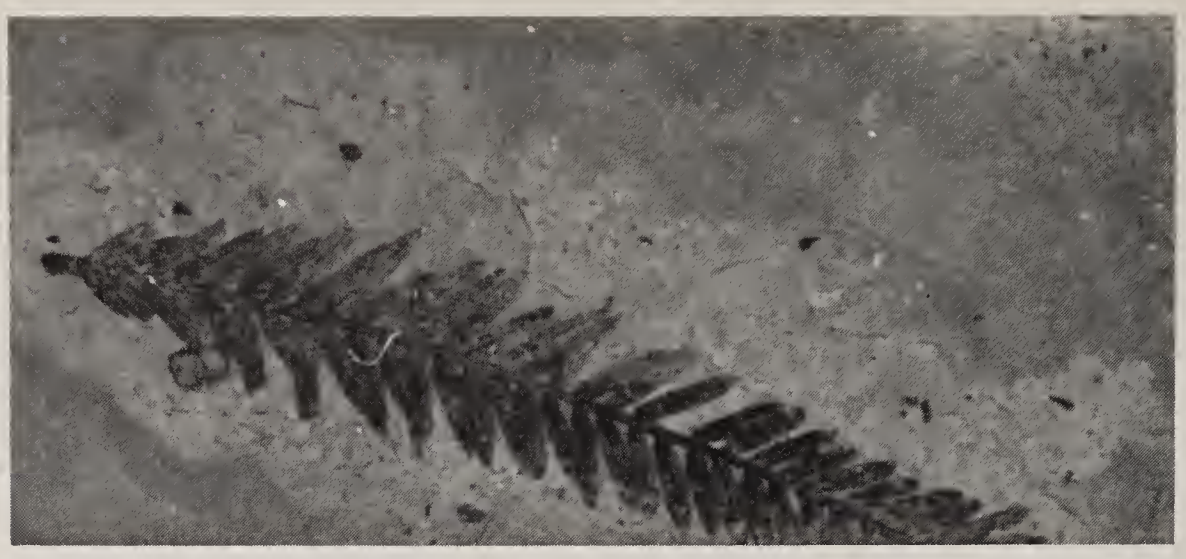
The caption for the photograph of *Primula modesta* var. *fauriei* 'Alba' (page 24) was exchanged with that of *Epilobium rigidum* (page 21).

Volume 45, No. 1, pages 2 and 3, Spring 1982

The photographs of slugs (both in and out) which were mistakenly attributed to Dr. Arthur Martin, were actually taken by Dr. Sigurd Olsen. Dr. Martin writes: "Dr. Olsen did such fine photographic work that his wife, my colleague Ingrith Deyrup-Olsen, and I frequently requested his help and we had these pictures already on hand."

Volume 45, No. 2, pages 2 and 3, Summer 1982

The berries shown on page 2 are actually those of a hybrid of *Sorbus prattii,* rather than of the species *S. prattii* itself. We regret that the photograph of *Larix kaempferi,* page 3, was inverted.



***Metasequoia glyptostroboides*, the dawn redwood, was very common in North America during the time of the Tertiary but is now found only in China where it has been protected near temples and monasteries. The fact that this tree is deciduous increased its chance of inclusion in the fossil record (page 35).**

Photo: R. Burnham

The Eocene in Washington— Almost Another World

*ROBYN BURNHAM**

Crashing through the underbrush, a young female oreodont snorts, and stops to browse on the foliage of a pecan. Rising on either side of this sheep-sized mammal are close relatives of walnuts and avocados, topped by towering subtropical dipterocarps. Near the shore of a small lake, the forest might remind a casual observer of one of the forests of eastern China or southeastern Mexico. On closer inspection we would discover genera that we recognize, but find that nothing is quite like any modern species, and in fact some genera are only superficially similar to those in our modern subtropical forests. This forest lived approximately forty-five million years ago, faithfully preserved by rapid volcanic ash burials and by river sediments flowing into an ancient floodplain. Geographically the forest grew not at tropical latitudes as we might have guessed from the rich flora, but just south of the present site of Seattle, here in Washington.

Paleobotany: More Than Just a Pretty Leaf

Paleobotany, the study of fossil plants, has been of interest to naturalists since the sixteenth century. In the early eighteenth century, taxonomy of fossil plants emerged as a science, and for over one hundred years, effort was devoted to naming and describing plant fossils. During the past thirty years however, paleoecology and paleogeography of fossil plants have joined taxonomy as major areas of study. As a greater diversity of fossil plants was discovered and described, there came the realization that plants have dominated the earth's surface for over four hundred million years. Rather than viewing the present vegetation as the perfection of millions of years of evolution, paleobotanists now recognize that geography, climate, and even grazing play roles similar to evolution in controlling the vegetation of the earth.

Visualizing the fossil flora as it was during its life is one of the goals of a paleobotanical

*Robyn Burnham is a paleobotanist working with fossil plants in western Washington. She has also studied fossil plants from the Gulf of Alaska while she was employed by the U.S. Geological Survey.

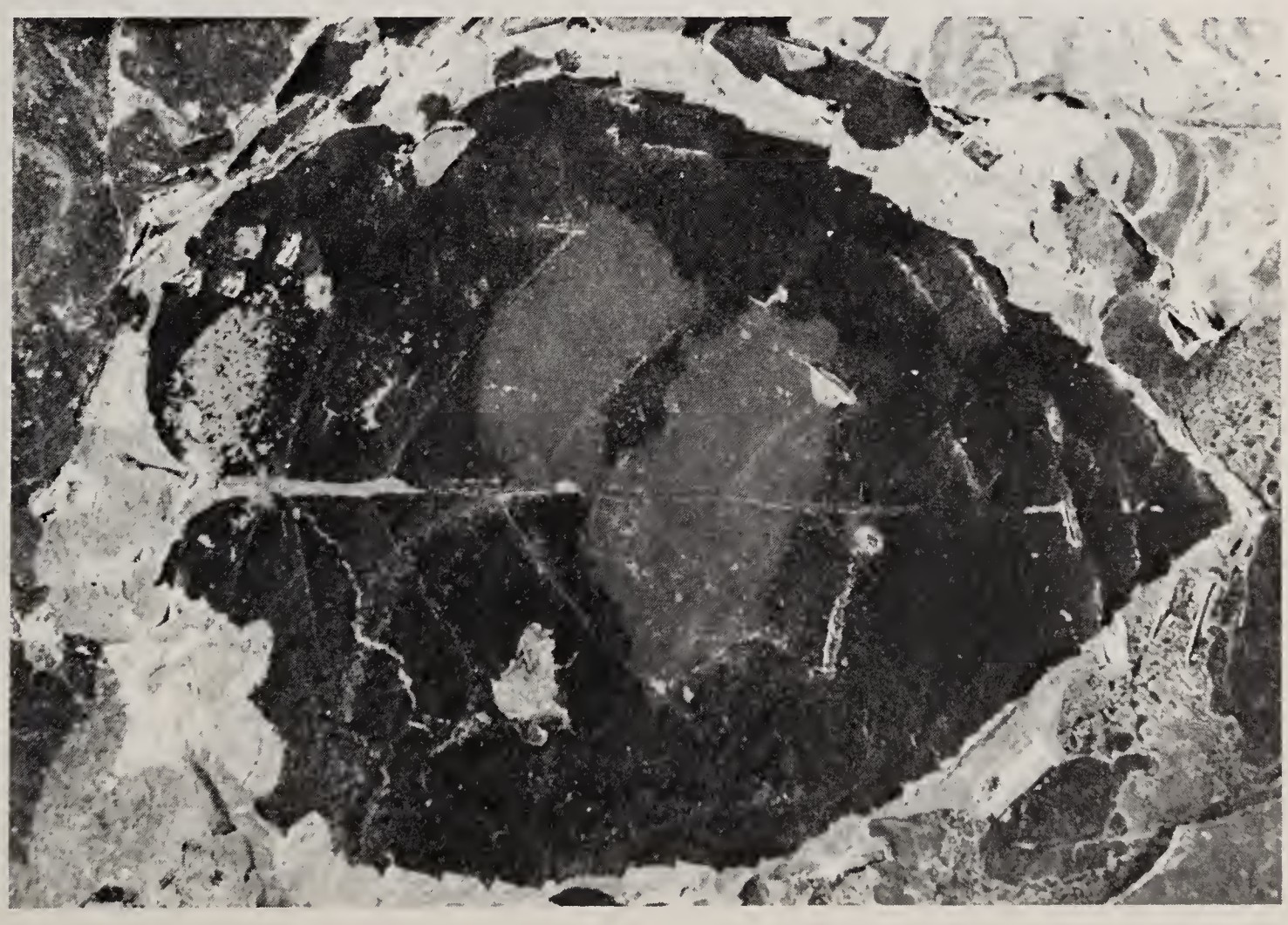
study. To do this effectively, the researcher must understand the geography (space occupied by river courses, valleys and hills) and topography (elevation of the land) of the area where the fossil plants were deposited and how the individual plant parts arrived at the lake, river, or swamp before they were buried in the sediments. It is easy to see that a broad leaf may float in a river before becoming waterlogged and sinking to the bottom. A heavy nut, however, will sink like a stone. A single pollen grain may float on the wind for many miles before settling on the water's surface which then carries it even further. The plants growing close to the site of deposition are much more likely to be preserved in the sediments than those plants living on the surrounding hillsides. Paleobotanists are aware that they are sampling a limited part of the vegetation, so to supplement the evidence (leaves and fruits) of lowland floras, the spores and pollen deposited in fossil muds and swamps are also analyzed. More clues to the physical environment come from the size and mineral composition of sediment grains enclosing a fossil flora. This may tell the paleobotanist how fast the water was moving, the direction of the source of sediments, whether volcanoes were closeby, and even the age of the rocks.

Angiosperms: Tertiary Dominants

Angiosperms (flowering plants) have been in existence at least since the Cretaceous Period (over 100 million years ago) and have been used by plant geographers as indicators of temperature, precipitation, and frequency of frosts in the past. Some modern plant groups (walnuts, elms, and katsura trees) have become restricted in their ranges since the Eocene (45 million years ago) and are found as fossils in areas far outside their possible modern ecological ranges. Striking examples of this are the fossil palms (*Sabalites*) found near Bellingham and on Swauk Pass in northwestern and west central Washington. Clearly a different climate must have existed in Washington during the times these plants lived! Because vegetation generally reflects the climate of a region, paleobotanists study modern areas of distinct climates to discover which features of the vegetation most accurately reflect the climate. From such studies we know that high percentages of large leaves, leaves with entire margins, and evergreen plants correlate with high temperatures, few frosts and abundant rainfall in the growing season. Tropical and subtropical forests contain many leaves with drip tips and jointed petioles (like those of the moonseed

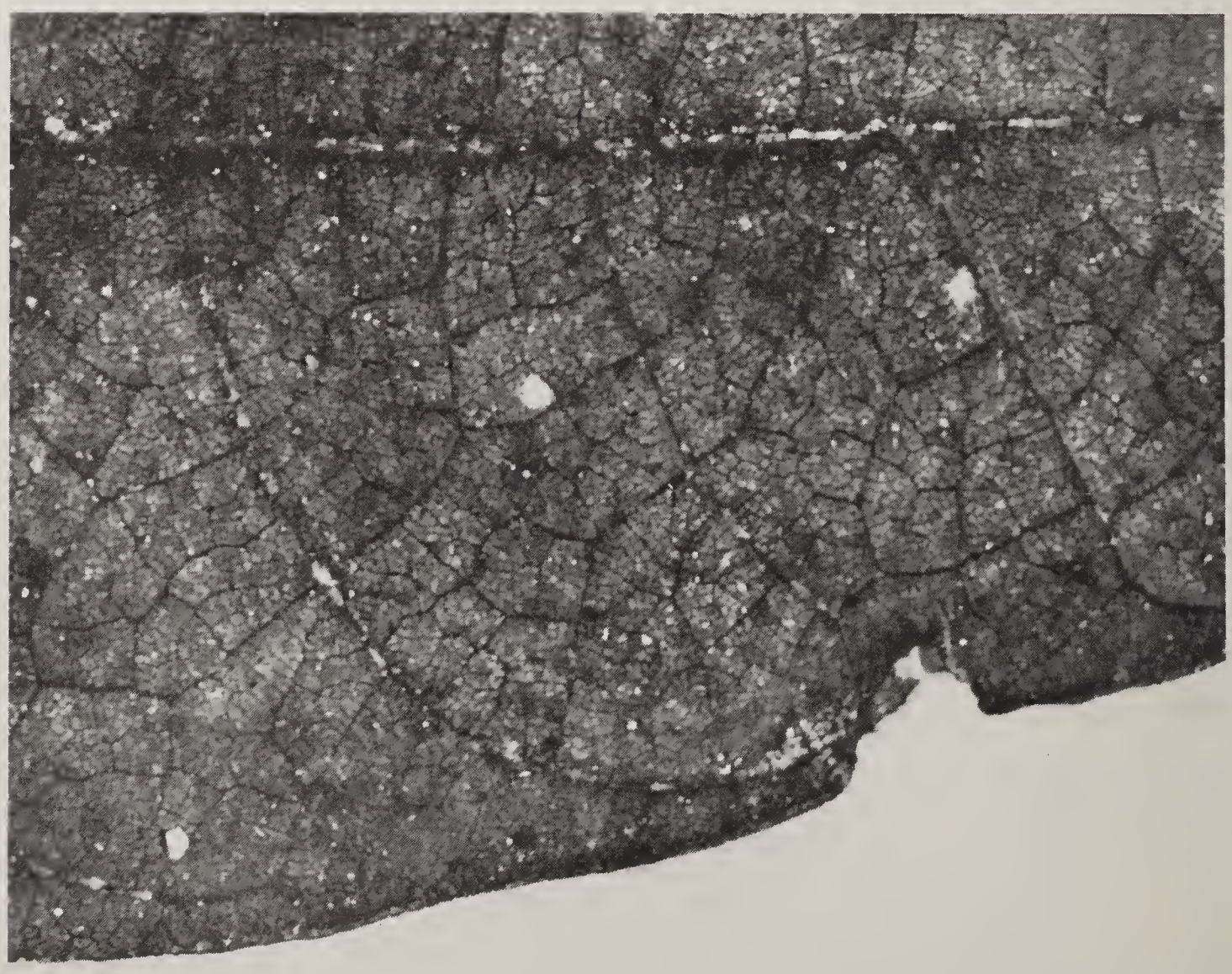
This fossil leaf shows the cordate (heart-shaped) base and dripping point characteristic of woody vines and understory plants in humid climates.

Photo: R. Burnham



Rock composed of volcanic ash may preserve leaves with amazing detail. This slab shows two *Viburnum* specimens (above) and a member of the Icacinaceae (below), probably a woody vine.
Photo: R. Burnham

An enlargement of the Icacinaceae (moonseed-family) specimen, showing marvellous detail of leaf veins.
Photo: R. Burnham



family) characteristic of the woody vines of these climates. Note that these features can be studied in a fossil flora, even without knowing the identity of a single plant. In addition, certain angiosperm families (Dipterocarpaceae, Menispermaceae, Icacinaceae) are largely restricted to moist tropical environments today. Assuming that a fossil leaf is correctly identified with one of these families, one may draw the conclusion that the fossil plant was similarly restricted in its living state, and that the climate at that time must have been warm and moist.

Fossil-bearing Rocks of the Puget Sound Area

Paleobotanists working near Seattle have studied a sequence of Eocene rock known as the Puget Group which spans at least four million years and probably more. The Puget Group has been dated as approximately 40 to 46 million years old, and in some areas such as the Green River Gorge, it is as much as two thousand meters thick. The rocks are composed of layers of silt and clays compressed into siltstones and shales alternating with layers of coal and sandstone. The finer-grained layers (siltstones and shales) contain the fossil leaf, fruit and stem compressions used by paleobotanists to reconstruct the Eocene forests. Geologists have portrayed the Puget Group as a deposit on a delta plain flanked to the east by volcanoes much more active than our present Mt. St. Helens. Each layer should be viewed as only a single frame in a moving picture of the past. The coals, mined since the 1850's, represent a time when less water and very little mud was brought into the delta plain by the ancient river, transforming small depressions in the flood plain into swamps filled with logs, leaves and other organic material. Under the pressure of sediments on top of the swamps, the plant material formed coal which represents only the plants in the swamps and may be different from the deposits entombed in mud or siltstone, representing floras of the slopes and areas around the coal swamp. When a sequence of rock like the Puget Group is exposed, paleobotanists are able to study the changes in the overall vegetation and in particular plants of one region.

The Flora

It is useful when recreating an ancient flora from the fossil record to think of each plant in terms of its place in the forest stratum: as a canopy tree, understory tree, or shrub of the forest floor. While it may be impossible to determine this for each specimen, as more complete collections are made and the floras are studied in more detail, many plant parts can be assigned to specific layers of the forest. The diverse canopy layers of the Eocene flora of Puget Sound contained many subtropical families. Representatives of the walnut family (*Pugetia*—an extinct genus, *Carya, Pterocarya),* the oak and chestnut family (*Dryophyllum, Castanea*), extinct members of the tropical Dipterocarpaceae (lofty trees which dominate the lowland rainforests of Asia, their seeds enclosed in a winged fruit), *Cryptocarya* of the laurel family and probably extinct members (*Plafkeria*) of the basswood family were common. The only conifers present in the fossil forest were *Glyptostrobus*, and the well-known dawn redwood (*Metasequoia*), both members of the redwood family (*Taxodiaceae*) currently endemic to China. The canopy was complex by our modern temperate standards: not only was there often more than one tree layer, but the canopy supported woody climbers of the moonseed family (Menispermaceae) and of the Icacinaceae. Stream and river courses were lined by taxa familiar to more temperate climates: alder, birch and katsura trees with sycamores and elms further back from the banks.

GEOLOGICAL TIME SCALE

Period	Beginning of Period Millions of Years Ago
(Cenozoic)	
QUATERNARY	
Holocene	
Pleistocene	2.5
TERTIARY	
Pliocene	
Miocene	
Oligocene	
Eocene	
Paleocene	65.
(Mesozoic)	
CRETACEOUS	140.
JURASSIC	

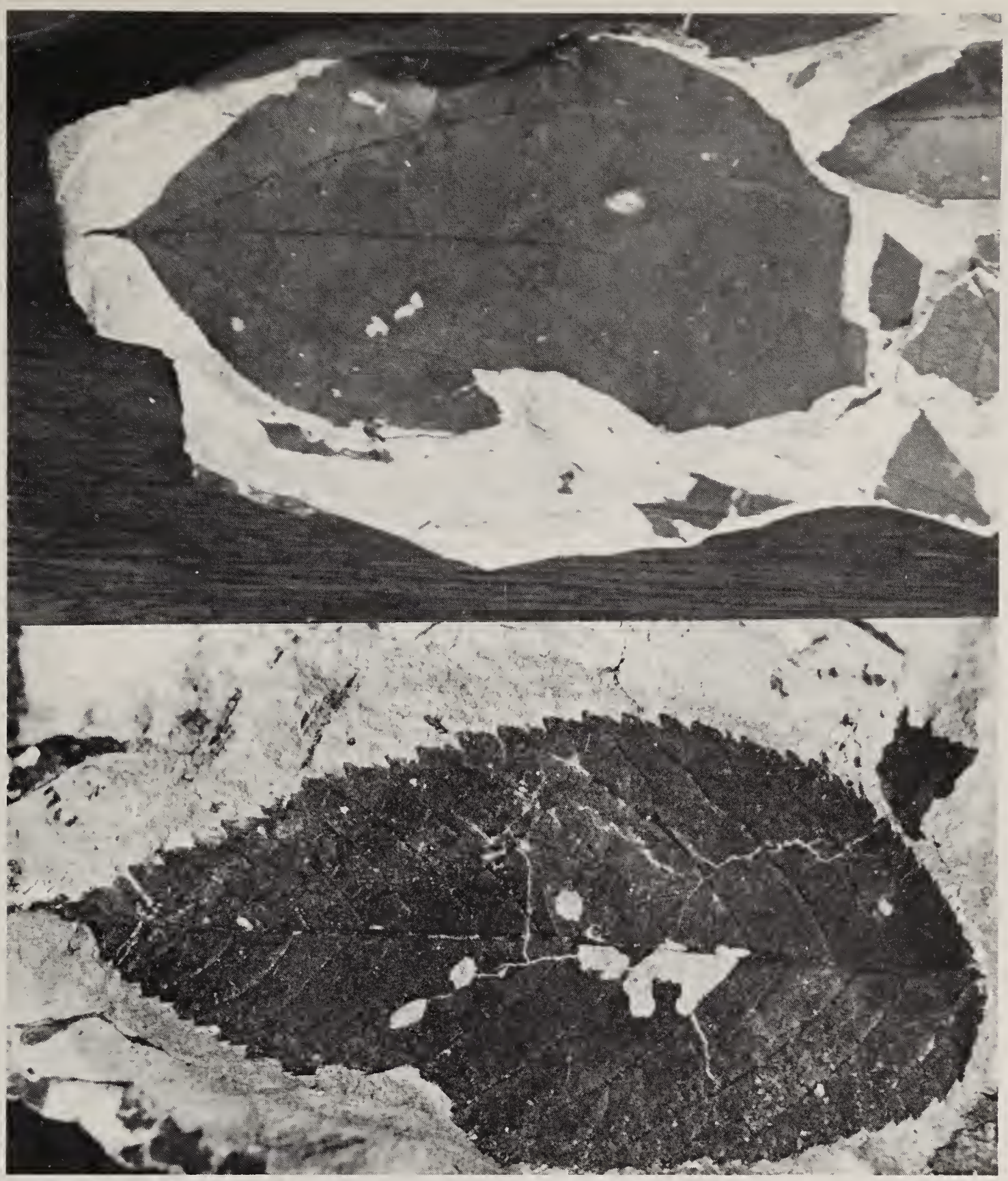
The understories of extinct floras are generally the most difficult to reconstruct because forest litter falls to the floor and rapidly decomposes rather than being buried by sediment. Some members of the understory of Eocene floras near Seattle were members of the fig and laurel families. The larger trees of the understory, especially deciduous species, may make a minor contribution to the fossil assemblage only when strong winds or stream currents carry their leaves onto a delta where they are rapidly covered by mud.

Herbaceous plants are rarely encountered in fossil floras similar to those of the Puget Group. These floras were deposited on deltas and floodplains where herbaceous plants may have flourished but whose leaves were not readily deciduous and so made up a smaller percentage of the forest litter. Although rare, ferns such as *Anemia*, *Allantodiopsis*, and *Hemitelea* are found at nearly every locality in the Puget Group, providing some evidence of the herbaceous vegetation.

Compared with our conifer-dominated forests of today, the Eocene forests of Washington were dominated by broadleaved evergreen species similar to those in the Mexican Yucatan uplands or southeastern Asia. These areas not only contain comparable taxa (*Ginkgo*, Mexican elm, dawn redwood and katsura) but share features of foliage which indicate that the fossil and modern forests grew under similar climatic conditions. The predominance of drip tips, cordate bases, and entire margins on many of the fossil leaves suggest rain forest or a subtropical climate which was present from at least central California to the Canadian border. There were few frosts and rainfall was most abundant during the summer months. This equable climate very likely extended east to central Washington since our modern mountain barriers were not in existence then. In the Eocene, the Pacific shoreline was close to Seattle, at times extending east at least as far as Tukwila. The equable climate may have been a result of the proximity of the ocean: oceanic climates tend to be milder than continental climates. Marine paleontologists also believe the climate was warm, having identified warm water corals and shells of salt water invertebrates from marine rocks of equivalent age just west of the plant deposits. Thus it seems the Puget Sound area was very different from what we see today, not only in the life it supports but also in its climate and topography.

The awesome size of old-growth Douglas fir or hemlock trees in the Pacific Northwest gives us a feeling of stability and stasis in our forests. However, if these trees were each as old as 400 years, and each preceding generation had lived to be 400 years old, it would take more than 100,000 forest generations to roll the clock back to Eocene forests of the Puget Lowlands, some forty-five million years ago. So in geological time, even our old-growth forests are ephemeral. Since the Eocene, summer temperatures have dropped and rainfall has been largely restricted to the winter months. Subtropical plants which had ranged from California to the Gulf of Alaska were unable to reproduce and went extinct in our area. Climatic change was not sudden, rather the fragile subtropical plants produced fewer and fewer seeds each year until the hardier plants took over, changing the forest's appearance and consequent input to the fossil record. Our modern northwest flora, the result of broadleaved extinction and replacement by conifers since the late Miocene, might leave a fossil flora dominated by fir, hemlock, and cedar needles with maple and alder leaves representing the deciduous understory and streamside plants.

Virtually none of the Eocene geography has been preserved for modern naturalists. Glaciers have carved and covered the evidence of the earth's history in our area to such an extent that to see the remnants of ancient plants and animals we must seek road and river cuts, coal mines, and landslides. When these are found exposing the Eocene story, we see indications of the changes which have shaped the Pacific Northwest during the past forty-five million years. The flat delta plain has been replaced by the Cascade Ranges and Puget Trough. Subtropical climates have turned to cool temperate. Oreodonts, hyracotheriums, and other Eocene ungulates have been replaced by bears, mountain goats and humans, and the mixed evergreen forests with flowering evergreen and deciduous trees in the understory have given way to our coniferous forests.



Above: *Calkinsia*, an extinct member of the moonseed family (page 35). Below: The serrate margin and oblique base indicate that this leaf belongs in the elm family, a family common in the Puget Group (page 35).
Photos: R. Burnham

Book Reviews

COTTAGE FLOWERS, by Marie Angel. Pelham Books, Ltd., London, 1980. 48 pages, consisting of 37 color illustrations with appropriate texts. Price: approximately $12.95.

A copy of this charmingly written book was given me to review for the *Bulletin*. I must admit that I approached it with skepticism. Was this just one more garden book to be thumbed through and put

aside? I found, however, that *Cottage Flowers* was a real treasure-trove!

As explained on the dust cover, "This book is not a history but an evocation of the old traditional flowers of the cottage gardens." Not only has the text been selected by the author, but the floral illustrations done by her as well. Bright color leaps from each page with remarkable likeness to the originals. The sketches are authentic—true to life.

In the Introduction to the book, Marie Angel states, "Cottage gardens date from the late Middle Ages, when flowering plants, in so far as they had a place at all among the onions and cabbages, were grown not for their beauty but for their usefulness: as simple medicines, as garnishes and flavourings, for wine-making, and to provide the cottager's bees with pollen and nectar . . . By the seventeenth century flowers were sufficiently accepted for themselves in the cottage garden for some to be disparaged because of their popularity."

Many of the floral specimens chosen are typical of the Victorian period. The late Vita Sackville-West makes this comment, "The tiniest garden is often the loveliest. Look at our cottage gardens if you need to be convinced." Let us consider some of the flowers to be found in cottage gardens. There are pinks, sweet william, and love-in-a-mist, wallflowers and forget-me-nots in spring and hollyhocks and Michaelmas daisies in autumn. Hyacinths, daffodils and March violets abound. Nostalgia for the past has brought with it a revival of taste for old-fashioned flowers: pinks and carnations, the old roses, tulips, pansies, and bachelor's buttons.

Cottage gardening still has much to offer the modern gardener. It is perfectly possible to grow vegetables and flowers in a happy blend as the cottagers did in the past. The small flowers are well suited to the smaller scale of the modern garden. You will enjoy this book and find the quotations on each page amusing. Do peruse this quaint volume when in a reminiscent mood. *Cottage Flowers* promises pleasant reading.

ROSAMOND P. ENGLE

POCKET FLORA OF THE REDWOOD FOREST, by Dr. Rudolf W. Becking. Island Press, Covelo, California, 1982. 237 pages, including glossary and index, with numerous line-drawings by the author and 8 plates with color photographs showing 29 plant species. Price: $15.00.

In a "note to the reader," the publishers of this pocket flora state—quite correctly—that it is a guide to a unique plant community. Still, the redwood region and western Washington have a great many species in common; this fact, and the high quality of Becking's work, make the book most valuable for our own "neck-of-the-woods," and justify a review in our *Arboretum Bulletin.*

Rudolf Becking started his training in Forestry at the University of Wageningen in the Netherlands and completed it at the University of Washington, where he received his Ph.D. degree in 1954. In his thesis, he explored and developed the idea that the suitability of a given site for growing Douglas fir (the "site-quality") can be judged not only in the conventional manner by paying attention to soil quality and to climatic and topographic factors such as rainfall and slope, but also by looking at the composition of the plant community growing in association with Douglas fir at that site. To provide the necessary basis for his ideas, Rudolf and Hilda Louise Becking traveled extensively in Washington, Oregon, British Columbia and northern California. In the process, Rudolf familiarized himself thoroughly with the floras of these regions. The present work is based on these experiences, plus at least two extra decades of tireless effort devoted more specifically to studying and drawing the plants of the redwood region. The high-quality drawings, clear and accurate, were all made by the author himself from living plants rather than from dried or pressed specimens as one so often sees (alas) in other floras. Thus 212 of the plants most frequently encountered in the redwood region are represented pictorially, in addition to being described in terse but by no means incomplete fashion. It is worthy of note that the elaborate glossary contains many line drawings by the author also; this is most helpful in explaining the botanical terms used. Furthermore, there are 8 plates showing color photographs of 29 plant species. The system of identification developed by Becking can serve both informed lay people and scientists. The terminology used in the descriptions and in the keys for field-identification is simple enough to make it possible for everyone who uses this book to determine precisely which plant is being described.

All in all, there is in this Redwood Flora very little indeed to take issue with. One could, perhaps, argue about some of the common names quoted. Is "white-stemmed raspberry" (for *Rubus leucodermis)* a better name than "blackcap"? And is "false lady's slipper" (for *Epipactis gigantea)* used more frequently than the more descriptive "stream orchid" or "chatterbox"? We doubt it! Likewise, some of the definitions given in the glossary can be considered dubious or inaccurate. Many types of flowers have long and slender styles, and it is therefore strange to read that a style is a *contracted* portion of a pistil between an ovary and a stigma. Also, some botanists may be upset by the statement that the sexual organs of a fern-gametophyte are usually placed on the underside of "a small, leaflike organ called a thallus." (Does the author mean a prothallus?).

However, such objections are minor. They can easily be met in later editions of this flora. We expect that there will be many of these, and hope that they will include some data from Becking's treasure-trove of information concerning the pollination and dispersal of the plants he describes with such admirable expertise and skill.

B.J.D. MEEUSE

Arboretum

The Washington Park Arboretum

Arboretum Annual Report

June 1, 1981-1982

J.A. WITT, Curator of Plant Collections
J. PIRZIO-BIROLI, Coordinator of Volunteers

Major Projects

Several major projects were completed during the year and several more are underway. Perhaps the most obvious has been the completion of the Conifer Meadow at the north entrance to the Arboretum. Informally known as "the Pit," this site was an ugly trench for a number of years after the demise of the R.H. Thompson Expressway. The site was acquired for the Arboretum, filled, and then contoured into a rolling surface. Mr. Eric Hoyte, University of Washington campus landscape architect, prepared a planting plan which made use of many conifers growing in the Arboretum's nursery. A commercial landscape firm actually did the moving in March and April, 1982. Many of the trees were over twenty feet tall. As this is written (August, 1982) the survival rate of the trees has been good, and it is hoped that the majority of them will be well established by next spring. This project, called for in the Arboretum Master Plan Update, was funded from the Arboretum Improvement Capital Trust Fund.

The replaced irrigation system, funded from the same source and reported in the 1980-1981 Annual Report, has been given a thorough testing by the staff. Despite some complications, it has worked well enough to free one gardener about half time to do maintenance work. When all the bugs have finally been worked out, it seems reasonable to expect an even larger relief from irrigation chores.

The Camellia Collection, most of which was planted in the late 1940's, has become quite overgrown. Many of the older plants, some 15 feet tall and nearly as broad, are interfering with each other and need to be pruned severely or moved to a more open location. A gift of some $10,000 was received from the Arboretum Foundation to improve the collection; work started in late fall, 1981. A new planting area (south of the existing collection) of about ¾ acre was cleared, graded, and the soil improved. Some 30 large plants were moved into it in March and April, and a pruning program was begun. About half the eventual moving has been finished; the remainder is planned for next fall and spring.

Another project, which has been underway for some time, was nearly finished this spring. The Memorial Area, sponsored by memorial funds from the Arboretum Foundation, has been planted with the majority of the rhododendrons called for in the plan. This site, a hillside on the east side of Azalea Way south of Loderi Valley, now contains rhododendron hybrids produced by American breeders. While by no means a complete collection, the 92

plants represent a comprehensive cross-section of what is available to the gardener interested in these plants.

The Seattle Department of Parks and Recreation assumed full management of the Japanese Garden on July 1, 1981. An admission charge for visitors was reinstated, and a full-time gardener and several part-time helpers have been added to the Garden's staff. An elaborate program for improving the condition of the Garden was prepared by the Park Department's staff and numerous changes are in the process of implementation. Although there is a change in jurisdiction, it has been agreed tacitly that the University will continue to maintain the plant materials in the Garden as part of the Arboretum's collections.

One of the most noteworthy projects has finally begun to show real progress. A Visitor Center which will enhance education and display at the Arboretum has been in the planning stage since the first Olmsted Master Plan in 1936. With the concurrence of the Arboretum and Botanical Garden Committee and the University, the Arboretum Foundation and the Seattle Parks and Recreation Department have signed an agreement for construction of a Visitor Center in accord with the updated Master Plan of 1978. A technical committee has prepared a program for the construction of the structure and for the necessary site improvements, and a Request for Proposal was published. Forty-seven firms replied with letters of interest and a selection committee chose five firms for further consideration. The final selection of the architectural firm was made in late July and the signing of the contract for designing the building and site will follow. Target dates call for construction to begin during the summer of 1983 with completion in 1984.

Although it certainly was not the best twelve months in the Arboretum's history, neither was it the worst. There were many disappointments and frustrations for those charged with operating in the areas of funding and staff. The current recession continues to be especially hard on our budget. The University funds the Curator and five staff members. The support of operations including supplies, equipment, utilities, and building and equipment maintenance, and of part-time and temporary staff must come from gifts, donations and grants. The steady and generous stream of contributions from support organizations, garden clubs and the public is gratifying and most appreciated.

However, certain aspects of the Arboretum's programs have been sharply curtailed. For instance, plant introductions (which in past years were an area of major emphasis) have been cut to a bare minimum. Instead of ordering a selection of seeds from the International Seed Exchange, we are now emphasizing wild-collected seeds of trees and shrubs especially from sources in northeast Asia, Chile, and New Zealand.

The eastern half of the greenhouse was closed during the winter yielding substantial savings in heating costs. Unfortunately, a number of tender species were lost when temperatures in the greenhouse dropped to near freezing. Surprisingly, several plants which we had assumed were tender survived, indicating an unexpected hardiness.

Greenhouse operations are now being managed by a Gardener Lead who devotes part time there and the remainder to his regular duties. A work-study student, Ms. Joni Dabbs, has been responsible for the day-to-day work in the greenhouse.

Operations

The staff continued the never-ending weeding, mulching, thinning, pruning, mowing, and trail maintenance that make up the less glamorous part of the Arboretum's upkeep.

Many volunteers gave valuable and welcome assistance to the maintenance staff again this year. This included weeding, pruning and general clean up, and saved our staff many hours of routine work. In several instances, volunteers with special skills were able to perform tasks for which we had budgeted no time. We would especially like to acknowledge the volunteer services of Mr. Ronald Brightman, who spent many hours pruning the *Philadelphus* and *Deutzia* collections, and of Mr. N. Dering Marrett, who has faithfully weeded the new heather planting in the Rhododendron Glen and the bulb bed by the office.

Staff

Two of our oldest, in terms of service,

employees retired during the past year. Mr. Richard van Klaveren, longtime propagator, retired in early summer (*Arboretum Bulletin* 44(2):2, Summer 1981). In May, 1982, Mr. John Pluschke retired after twenty-one years' service. Hired first as an equipment operator, then advanced to Truck Driver, he finally was classified as Gardener Lead. John was one of those people who could be assigned nearly any job: digging a ditch, pruning rhododendrons, removing a dangerous 80-foot cottonwood without damaging the surrounding landscape, and driving any equipment in the Arboretum. His humor and willingness to tackle any problem will be missed.

Ms. Sarah Tatman, Gardener I, resigned and was replaced by Mr. Robert Hilzinger in January, 1982.

Plantings

As mentioned above, much of the planting for the past year was concentrated in the Camellia Collection, the Memorial Area, and the Conifer Meadow. Only 101 plants of 20 taxa were planted in addition to those areas.

Seeds and Plants Acquired and Distributed

The number of seeds and plants ordered and received during the past twelve months has been the lowest in years. The 149 kinds of seeds and 107 kinds of plants were received from 54 sources. Among these were a number of gifts which included eight mature rhododendrons and azaleas from the garden of Mrs. Myrtle deFriel on Evergreen Point through her daughter, Mrs. Arthur Gardiner; 18 azaleas from Mr. William Griswold; 18 small plants of 13 taxa from Carl Ferris Miller, Cholippo Arboretum, Korea; and 11 seedlings of Chinese trees from the People's Republic of China distributed by the Botanical Garden, University of British Columbia.

We distributed 107 plants or cuttings to 17 other institutions or nurseries during the same period and sent out 2163 packets to 212 sister institutions through our seed exchange. The seed exchange has in recent years included increasing numbers of wild-collected seeds native to the Pacific Northwest and the intermountain regions of Idaho and Utah. This is largely through the efforts of Director Emeritus Brian O. Mulligan and his wife, Margaret, who spend much of their autumns collecting seeds for our list. Twenty volunteers were involved this year in the distribution of seed for our Index Seminum.

Staff Activities, Meetings and Lectures

A highlight of the year was the visit of two distinguished botanists from the People's Republic of China in March. Professors He Shana, Research Professor at the Sun Yat-Sen Memorial Botanical Garden, Nanking, and Zhang Aolou, Curator of the Kunming Botanical Garden, Kunming, Yunnan, spent several days in the area as guests of the Center for Urban Horticulture and the Arboretum. In addition to giving a seminar on "Botanical Gardens of China" and a public lecture on "The Species of Rhododendrons in the Salween Area of Northwestern Yunnan," they were taken on a cross-Cascades trip to Vantage and Wenatchee.

Professor Witt gave 13 public lectures, mostly to garden clubs, on subjects concerning the Arboretum and its plant collections. He also was co-instructor in Botany 331, Ornamental Plants, with Professor A.R. Kruckeberg during the Spring Quarter. In addition, he taught two continuing education classes, one a lecture course on spring-flowering trees and the other consisting of a field trip across the Cascades into the desert. Mrs. Pirzio-Biroli gave eight assorted lectures and tours and led the Explorers' Walks.

In October, Professor Witt attended the meeting of the International Society of Arboriculture, Pacific Northwest Chapter, in Port Townsend where he served as Nominating Committee Chairman. Mrs. Pirzio-Biroli and Professor Witt attended the Western Regional Meeting of the American Association of Botanical Gardens and Arboreta held in Vancouver, British Columbia, in May.

The Center for Urban Horticulture and the Arboretum prepared a display of "Edible Ornamentals" at the All About Fruit Show in the Seattle Center in October. The booth had examples of various edible fruits from ornamental trees and shrubs growing in the Arboretum. A selection of jams, jellies and conserves made from the fruits was available for the public to taste.

In March, an exhibit—The Wide World of Plants—was prepared for the Arboretum Foun-

dation's Spring Horticultural Display at Southcenter. This display consisted of cut flowers or branches from trees and shrubs growing in the Arboretum. The country of origin of each specimen was indicated. All continents except Antarctica were represented by several specimens. A Volunteers and Arboretum Activities table was staffed by volunteers during the two days of the exhibit.

Arboretum Volunteers

The Arboretum's volunteer program continues to grow as an important adjunct to staff activities. Each day of the week a different person serves at the reception desk from 10 a.m. to 4 p.m. In order to allow greater flexibility for our regular office staffers, over 20 persons are available as substitutes for this invaluable work. In addition, the office is staffed on Sundays in spring by four people each day.

Beginning in January 1982 under the leadership of Mrs. Hazel Fiedler, we began a program of weeding by volunteers on the fourth Thursday of each month. The success of this program has depended upon the kind of publicity we have received before each Fourth Thursday. Individuals who have helped us with grounds maintenance at other times have been mentioned above under "Operations." Once again, the high school group "Los Amigos" gave a whole Saturday to cleaning up the Arboretum, a workathon to raise funds for their project in Latin America. In addition, several Arboretum units have taken responsibility for weeding specific sections of the Arboretum.

Our tours are conducted by a corps of more than 65 active guides who lead groups throughout the Arboretum, including the Japanese Garden. From June 1981 through May 1982, 151 tours were conducted for almost 4000 people. Those requesting tours included school classes, senior citizens, garden clubs and conventions. On the five Sundays in May, two General Arboretum Guides led public tours each day.

The public lecture series begun in the Spring of 1981 has continued on a Wednesday of each month except in December and midsummer. These lectures are free to the public and are especially recommended for our Arboretum Guides. Subjects ranging from fall color to hollies and other plant groups were presented by members of the staff and by experts from outside the faculty and staff.

Guide training series were offered for new and experienced Native Plant and General Arboretum Guides. Twenty-two people participated in the Native Plant training organized by Mrs. Peggy Eagle. Mrs. Pirzio-Biroli gave a double training series (Wednesday/Saturday) for 19 persons. The Saturday sessions were intended to develop a corps of weekend guides. The Explorers' Walks were incorporated into the guide training from February through April. Mrs. Pirzio-Biroli repeated for the Saturday class those Wednesday lectures which were included in the training series.

Work that takes place in the Arboretum is not the only volunteerism upon which we rely. We have schedulers for tours and for the Sunday Office Staffers, who do most of their telephoning from their homes. Our programs would not be so successful were it not for the continued support of the Arboretum Unit Council which provides many of our volunteer personnel. In addition, the Arboretum newsletter, which has come to be known as the "Pink Sheet," has helped to publicize our volunteer programs. Compiled by Mrs. Pirzio-Biroli, it is partly supported by the Arboretum Foundation, both in the cost of printing and in the distribution.

Weather

The past twelve months have been slightly cooler than average, with a moderate increase in precipitation in comparison with the last several years. The warmest day, August 9, 1981 when the temperature reached 37.2 C. (99 F.), caused some sun injury to a few plants, but the damage was not severe. There was a cold period in the first week of 1982. We had two days in which the temperature did not rise above freezing; the low for the year, -10.6 C. (13 F.) was recorded. Very little cold injury to the plants was noted beyond some defoliation of tender species. Although there were five nights in April with a few degrees of frost, any damage was restricted to open flowers and even this was quite minor. In fact, the flowering of the early magnolias, cherries and camellias was exceptionally good.

WEATHER RECORD

	Precipitation		Temperature* Maximum		Minimum	
	mm	(in)	°C	(°F)	°C	(°F)
1981						
June	53.3	(2.13)	27.8	(82)	6.1	(43)
July	37.2	(1.49)	30.0	(86)	7.8	(46)
Aug	9.5	(0.38)	37.2	(99)	10.0	(50)
Sept	73.5	(2.94)	32.2	(90)	4.4	(40)
Oct	153.0	(6.12)	19.4	(67)	1.1	(34)
Nov	124.4	(4.98)	18.1	(65)	-2.2	(28)
Dec	176.4	(7.06)	11.0	(51)	-2.2	(28)
1982						
Jan	121.9	(4.88)	12.2	(54)	-10.6	(13)
Feb	185.8	(7.43)	15.6	(60)	-6.1	(21)
Mar	92.2	(3.69)	16.7	(62)	-1.1	(30)
Apr	61.6	(2.46)	26.1	(79)	-0.6	(31)
May	15.9	(0.64)	28.3	(83)	2.2	(36)
Total	1104.7	(44.19)				

*Days with maximum below 0° C (32° F) = 2
*Days with minimum below 0° C (32° F) = 43

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Arboretum Library

Much progress has been made in organizing the library thanks to the valuable volunteer contribution of Mrs. Lyn Sauter, a professional librarian. A system has been devised for checking in journals and routing them to those on the faculty and staff who wish to see

them. After corresponding with botanical garden and arboretum librarians throughout the country, Mrs. Sauter made the decision to catalog the books according to the Library of Congress classification. Preliminary cataloging was done by the office volunteers. So far, about 15% of the books in the library have been cataloged.

Classes of Interest

Urban Horticulture—Arboretum

These classes are open to the public. Many of them start in January. To register and for further information call (206) 545-1373.

A NEW LOOK AT TREE FORM, with J. Clark and J. Pirzio-Biroli, two morning sessions.

NATURE PHOTOGRAPHY, with Bernard Nist, four evening sessions.

BIRD IDENTIFICATION FOR BEGINNERS, with Merilyn Hatheway, six morning sessions.

CULTIVATED CONIFERS, with Joseph Witt, six morning sessions.

HOME FRUIT GROWING, with Gary Moulton, one evening session.

FRUIT TREE PRUNING, with Gary Moulton, one six-hour session.

THE ARTICHOKE UNVEILED—VEGETABLE BOTANY, with Susan Libonati-Barnes, five evening sessions.

GRAFTING ORNAMENTALS, with Richard van Klaveren, two morning sessions.

PROPAGATION AND HARDWOOD CUTTINGS, with Richard van Klaveren, two morning sessions.

PESTICIDES FOR THE HOME GARDEN, with Van Bobbitt, two evening sessions.

COLOR IN THE WINTER GARDEN, with Jan Pirzio-Biroli, one morning session.

SPRING PRUNING OF ORNAMENTALS, with Chico Narro, two morning sessions.

Arboretum Foundation—Unit Council

These classes are open to all Arboretum Foundation members. Most of these courses begin in early February. For further information, please call the Arboretum Foundation office, (206) 325-4510.

HOUSEPLANTS—CARE, PROPAGATION AND SELECTION, with Doreen Kost, two morning sessions.

BASIC PRUNING with Cora Gardiner, two morning sessions.

IKEBANA—THE JAPANESE STYLE OF FLOWER ARRANGING, with W. Waggoner, R. Collins, E. Rathje, T. Sorrels and G. Green, two afternoon sessions.

PLANTS FOR YOUR WINTER GARDEN, with Jan Pirzio-Biroli, one morning session.

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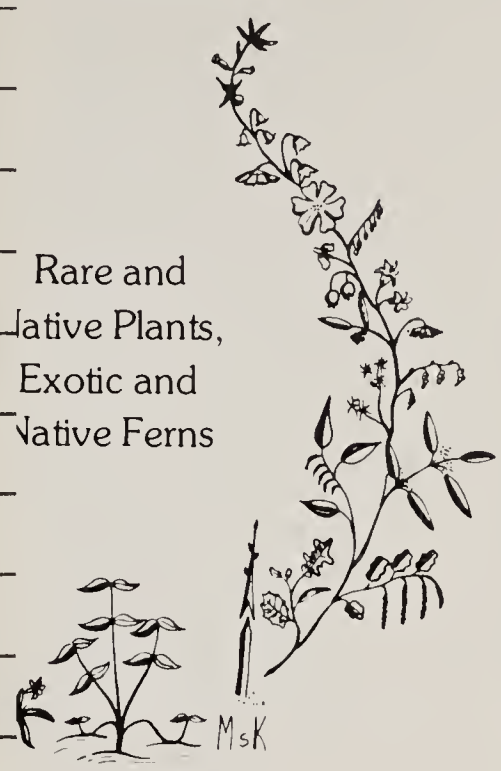

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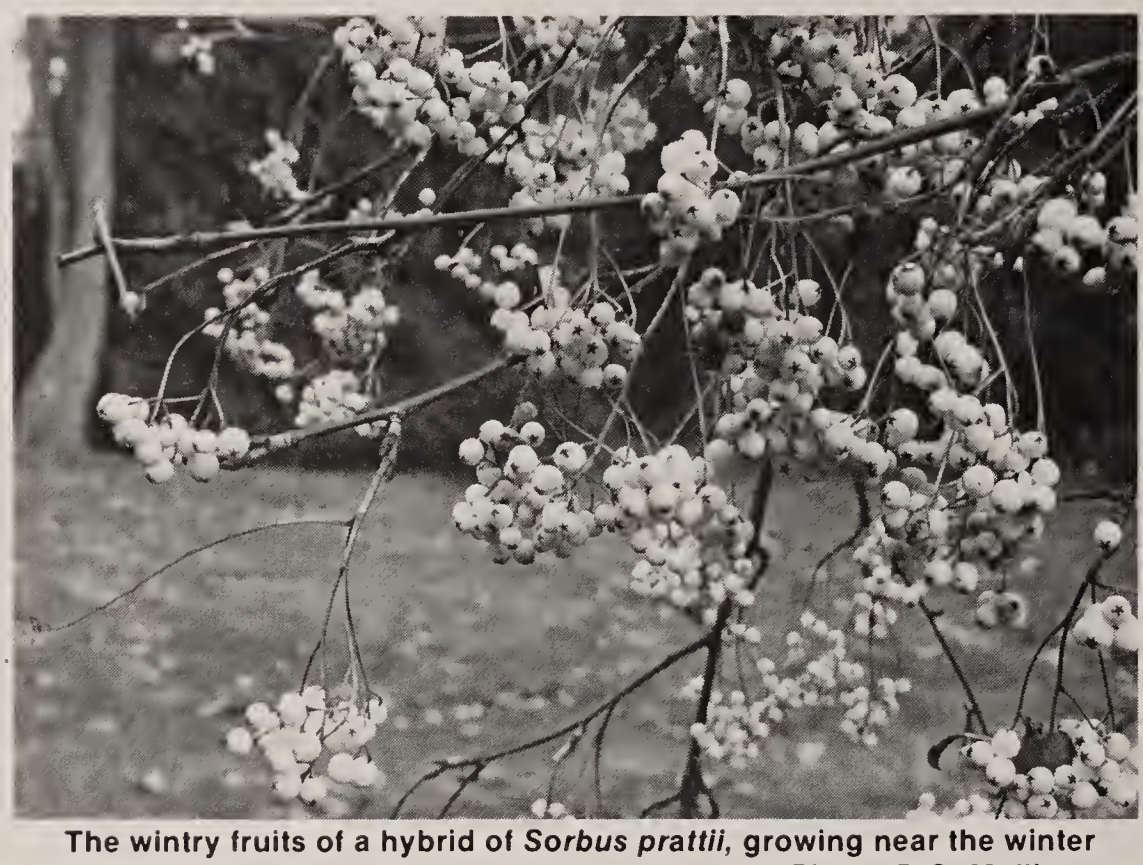

The wintry fruits of a hybrid of *Sorbus prattii*, growing near the winter garden. **Photo: B.O. Mulligan**

VISIT YOUR ARBORETUM FOR THE END-OF-AUTUMN

Attractions for two faces of autumn:
Frost and tree limbs in the sparkling cold,
And flowers for short gray days.

The Winter Garden begins to bloom with *Camellia sasanqua;* you can see *Viburnum farreri* now, and the other deciduous viburnums later this season. And the autumn cherries will flower sporadically from now until spring.

Join the Explorers' Walks meeting at 10 AM December 29, January 26, February 23, and March 23 in the Arboretum Administration Building Parking Lot. PLEASE WEAR ADEQUATE FOOTGEAR.